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COMMUNICATIONS

VISION AND ILLUMINATION IN COAL MINES WITH REFERENCE TO MINERS' NYSTAGMUS

BY

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PART I

In spite of individual opinions to the contrary (1, p. 18; 2) it is now generally agreed (3, p. 322; 4, pp. 201-202; 5, pp. 6 and 60; 6, p. 7; 7, pp. 238-239; 8, p. 509) by medical authorities that deficient illumination is the chief factor in causing miners' nystagmus though it is admitted that other contributory causes may exist. The low power of dark adaption of the fovea prevents the functioning of this part of the retina in very dim lighting such as generally obtains underground in coal mines, and it is believed that it is the long continued inability to make use of fovial vision that causes mine-workers to develop nystagmus after years of work underground. (9, p. 113) (The average age of mine-workers when the disease becomes so bad that they can no longer work in the mine is about 42 years, and the average number of years spent working underground about 26 years.) (5, p. 51). Whether or not it is continued difficulty in fixating vision that is the immediate cause of the disease is a question that is not easy to answer. At illuminations so low that the fovea cannot function properly it is undoubtedly difficult to fixate, but there is evidence to show that fixation can

actually be accomplished at values of brightness considerably below those commonly met with in mining practice. (10) It is, however, significant that in cases of congenital total colour blindness in which it is believed that vision is mediated exclusively by the retinal rods and in which, consequently, foveal vision is impossible, symptoms of nystagmus, irrespective of the subject's occupation, are almost invariably present. (11, p. 198; 12, p. 257).

It would seem safe, then, to assume that to abolish nystagmus we must provide sufficient illumination to allow the fovea to function normally (whether for fixation purposes alone or not) and this paper is devoted to an examination of the evidence available as to what is the minimum illumination necessary for this purpose.

It is usually accepted that the so-called point of change-over from peripheral to foveal (or from rod to cone) vision is shown by the knee or bend in the brightness—acuity graph and brightness—critical flicker frequency graph and it is proposed to examine the available evidence. Incidentally, it is worth keeping in mind that the threshold brightness of the fovea is considerably lower than the brightness at the knee of either of the above curves. According to comparatively recent work by Hecht (13), the average value of the threshold for 15 subjects was $3{\cdot}37 \times 10^{-4}$ ml. ($=10^{-4}$ c/sq. ft. approximately). This figure was for a test object subtending an angle of 2·5° at the retina and the image was thus within the limits of the rod-free area, although extending outside the true foveal area.

Taking first the brightness-acuity curve, the author has plotted König's classical results (14) in Fig. 1. König's original figures for his own eye for white light have been used after grouping certain of his numerous points and converting his brightness units to candles per square foot (c./sq. ft.) units (on the assumption that König's unit was equivalent to 0·0213 c./sq. ft.)* It will be observed that the centre of the bend near the foot of the curve occurs at a value of brightness of $\bar{3}{\cdot}3$ log. c./sq. ft. (=0·002 c./sq. ft.), the bend straightening out at about $\bar{3}{\cdot}5$ log. c./sq. ft. (=0·003 c./sq. ft.). The corresponding values of acuity are not of interest to us and, indeed, are only relative.

Hecht (15, p. 259) estimates the value of brightness at the knee of König's brightness—acuity curve to be 0·0072 ml. (=0·0021 c./sq. ft.)—a figure that appears to have been accepted by several authorities on miners' nystagmus.

According to Hecht (16), the data of Roelofs and Zeeman (1919) on the relation between brightness and acuity give, after the

* König's unit of illumination was that of a Hefner lamp at a distance of 1 metre. The co-efficient of reflection for the white paper used is assumed to be 0·8.

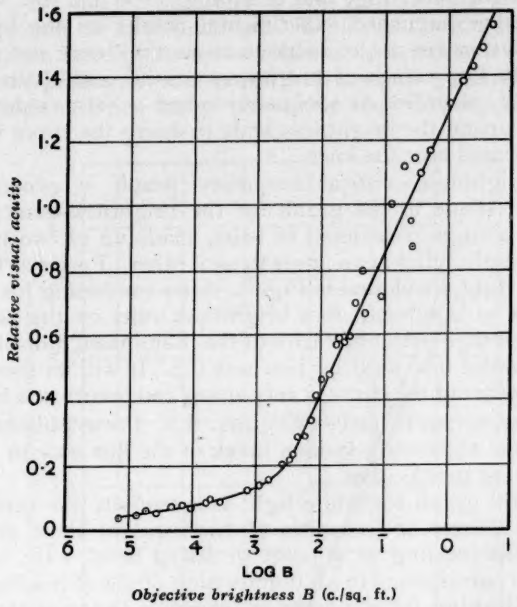

FIG. 1.—*Objective brightness and visual acuity* (König's data)

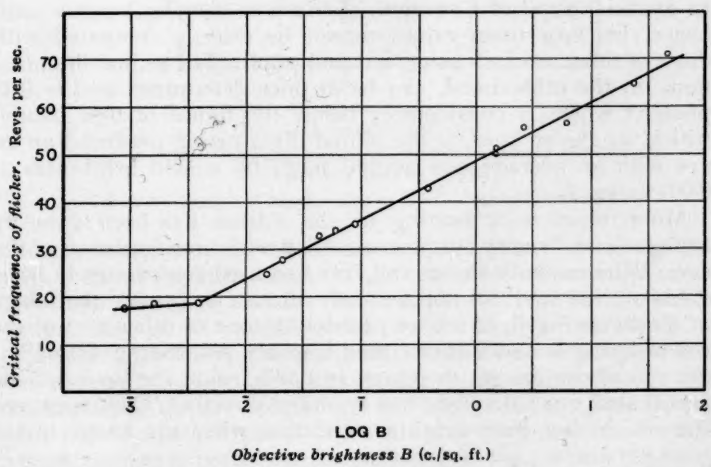

FIG. 2.—*Objective brightness and critical speed of flicker* (Porter's data)

necessary modification for units, a curve fitting in very closely with, and corroborating, that of König.

Most other published experimental results on the brightness-acuity relation are not of value to us as they were not carried to sufficiently low values of brightness or the conditions were not completely controlled or adequately noted or, else, readings were too far apart on the brightness scale to define the curve with sufficient closeness near the knee.

The brightness—critical frequency graph is generally very similar in shape to the graph for the brightness-acuity relation and may also be considered as being made up of two lines more or less straight lying at an angle to each other. Porter's (17) results for white light are plotted in Fig. 2. After converting his illumination units to candle/sq. foot brightness units on the assumption that the average reflection factor of the illuminated half-black, half-white rotating disc used by him was 0·5. It will be seen that the knee or corner of the curve is very sharp and occurs at a brightness of $\bar{3}$·57 log. c./sq. ft. (=0·0037 c./sq. ft.). Porter, himself, points out that the apparently sudden break in the line may in reality be only a rather sharp curve.

Ives' (18) graph for white light is essentially the same as that given by Porter and consists of two straight lines at different inclinations meeting at a point or sharp bend. He states that this point corresponds to an illumination of 2·5 of his illumination units. Allowing for the average reflection factor of the rotating disc used, this is equivalent to an objective brightness of 0·38 candles per square metre (=0·036 c./sq. ft.). Ives, however, used an artificial pupil of 1 sq. mm. aperture in viewing his disc and, hence, his brightness values cannot be directly compared with those of other workers using a naked pupil. The retinal illumination, on the other hand, can be at once determined and is 0·38 photon* which is considerably below the figure of 0·89 photon which, as shown later, is the retinal illumination produced on an eye with an average size natural pupil by a field brightness of 0·004 c./sq. ft.

More recent work bearing on the subject has been done by Lythgoe and Tansley (19) in connection with the adaptation of the eye. Whereas both Porter and Ives had used comparatively large fields of view and did not seriously attempt to confine the image of the flickering light source precisely to one or other part of the retina Lythgoe and Tansley used a source subtending only 1° at the eye whose image, therefore, just fell inside the limits of the foveal area when the light was regarded directly. They measured the critical frequency-brightness relation when the image of the

* See footnote to p. 139.

light source fell on the retina at angular distances from the fovea of 0°, 10°, 50° and 90° respectively and with varying brightnesses of background or surroundings. Their results show that only under certain conditions is the relation depicted by two straight lines meeting sharply at a point, but that, in general, the lines are curved, and while composed of two distinct portions inclined

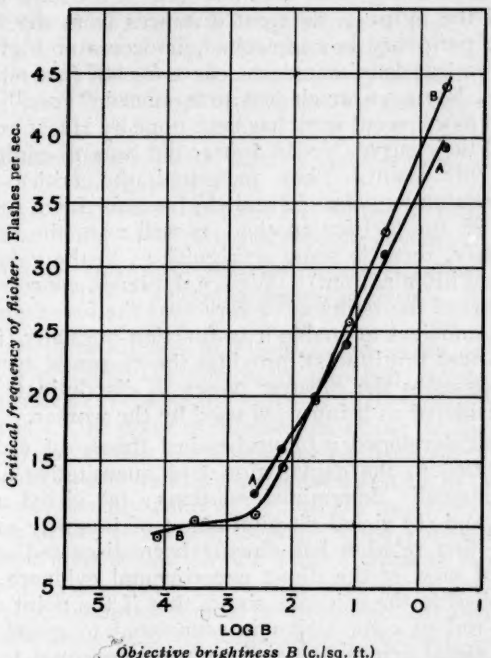

FIG. 3.—*Objective brightness and critical frequency of flicker*
(Lythgoe and Tansley's data)
Curve A—Centre of fovea. Curve B—10° from centre of fovea

to each other, the knee of the curve is not sharp or well-defined. Fig. 3 shows in terms of our brightness units the average results for three observers and for two positions of the image on the retina, *viz.*, at 0° and 10° from the fovea. (It represents the particular case where the surrounds were the same brightness as the test-patch.) As might be expected, on the assumption that the lower part of the previous curves for acuity and for flicker represent rod or scotopic vision and the upper part cone or photopic vision, the lower portion of the curve for 0° (*i.e.*, where the image fell entirely within the rodless fovea) is missing. At 10° from

the fovea where both rods and cones are found in the retina the curve shows a definite bend or knee at approximately $\bar{3}$·4 log. c./sq. ft. (=0·0025 c./sq. ft.) the upper comparatively straight part of the curve commencing at a brightness of about $\bar{3}$·6 log. c./sq. ft. (=0·004 c./sq. ft.).

Further, Lythgoe and Tansley's original curves appear to show that the point of change-over does not occur at the same brightness for parts of the retina at different distances from the fovea, but that, as the periphery is approached, it occurs at higher values and with even less definiteness, the curve for 90° (not reproduced), for example, having a much less pronounced "knee" than that at 10°. Still more recent work has been done by Hecht and Verrijp (20, 21) and their curves would appear not only to confirm but to emphasise this point. They measured the critical-frequency brightness relation at points 5° and 15° from the fovea for one subject and at 5° and 20° for another, as well as at the fovea itself. (Unfortunately, there is some ambiguity as to the value of their unit of retinal illumination.) We are, however, concerned chiefly with that part of the retina at or very near the fovea which, when the light is sufficient to enable it to function normally (*i.e.*, above the change-over brightness), provides the means of accurate fixation and possesses the greatest power to discriminate form and may be considered as being most used by the worker.

Hecht has developed a photochemical theory of vision which he has applied to the explanation and quantitative analysis of two experimentally determined relations: (*a*) visual acuity and brightness and (*b*) visual discrimination of intensity and brightness. The first relation has already been discussed above from the point of view of the direct experimental evidence. Hecht's theory applied to the evidence shows that if the point of change-over from rod to cone vision is considered to occur when the calculated visual acuity values for cones are equal to those for rods, then this point corresponds to a brightness slightly less than 0·00269 ml. (=0·000796 c./sq. ft.) (16, Table 1, p. 265.) On the other hand, when Hecht applies his theory to the discrimination of intensity brightness relation he finds that the point of change-over occurs at a brightness somewhere between 0·00732 ml. (=0·020216 c./sq. ft.) and 0·0190 ml. (=0·00562 c./sq. ft.) (15, p. 259.) This is a value some three to seven times that just mentioned as obtained from the acuity-brightness relation. (The intensity discrimination-brightness relation plotted as a curve does not exhibit any direct evidence as to the point of change-over, there being no sudden change of direction of the curve anywhere.)

While it is possible that Hecht's analysis does show in a general way what is happening in the retina of the eye (for example, why

acuity varies with illumination in the way it does), his quantitative deductions must be treated with considerable reserve owing to the nature of the assumptions which he makes.

Tabulating the various values of objective-brightness mentioned above corresponding to the point of change-over we have

	Candles per sq. foot
1. *Brightness-Acuity curve* (König), centre of knee ...	0·002
Do. foot of upper straight portion ...	0·033
Do. change of slope (according to Hecht)	0·0021
Do. Hecht's photo-chemical analysis—below	0·000796
2. *Brightness-Flicker curve* (Porter), intersection of straight lines	0·0037
Do. (Lythgoe & Tansley), centre of bend	0·0025
Do. do. foot of upper straight portion ...	0·004
3. *Brightness-Intensity-Discrimination relation*, Hecht's photo-chemical analysis ...to	0·00216 to 0·00562

Neglecting those figures of Hecht based solely on theoretical analysis and dividing the remainder into two groups according as they represent (*a*) the actual point of change-over from rod to cone vision, *i.e.*, the point of intersection of the two lines forming the graph or the centre of the connecting bend or (*b*) the point where the change-over may be considered complete in those graphs where it is not sharply defined, *i.e.*, where the curve straightens out after the bend, we have an average value of 0·0026 c./sq. ft. for the former and 0·0035 for the latter. Now it is not known how much, if any, above the change-over point the brightness and, hence, the illumination must be maintained to prevent nystagmus and some factor of safety would appear desirable. The author suggests a value of 0·004 c./sq. ft. as a round minimum value to be modified if necessary in the light of future experience or experimental work. The somewhat indefinite nature of the figure must be emphasised. It is obvious from the weight of evidence produced that the change-over is not sudden or sharp-cut.

Now, since the change-over from rod to cone vision is a retinal process it is to be expected that it will correspond to a definite value of retinal illumination which is a function of both the objective brightness and the pupillary aperture. Since (with the exception of Ives who, as stated, used an artificial pupil) none of the investigators concerned recorded the pupil apertures of their subjects, we can but assume that they were average normal values. Hence, if all mine-workers had average size pupils a coal-face brightness of 0·004 c./sq. ft. ought to be sufficient to prevent

nystagmus. However, pupil apertures vary widely from one individual to another and allowance should be made for the smallest normal pupils met with in practice.

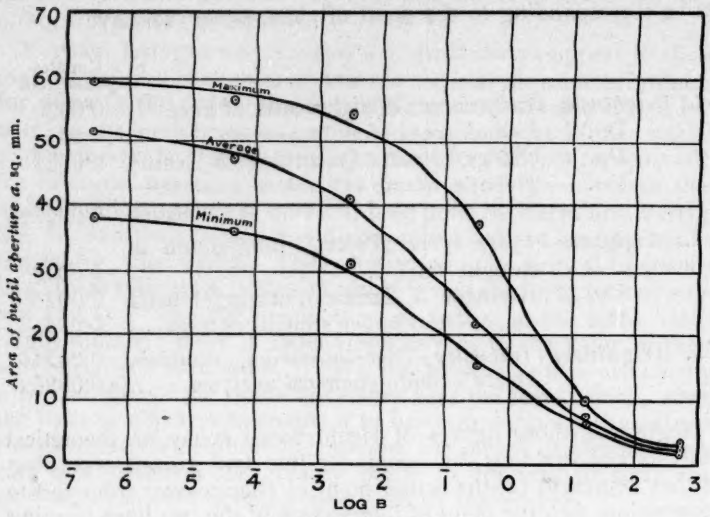

FIG. 4.—*Objective brightness and pupil aperture* (P. Reeves' data)

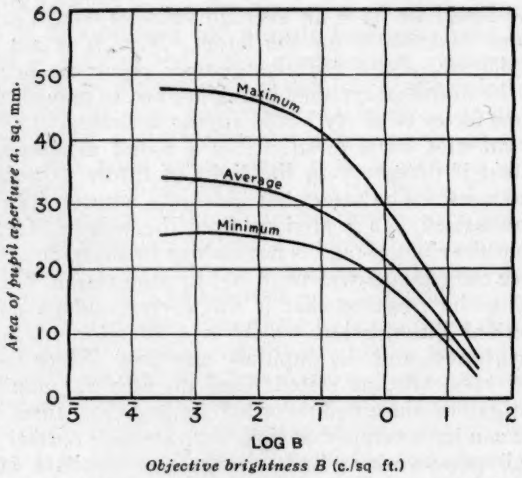

FIG. 5.—*Objective brightness and pupil aperture* (Holladay)

Measurements of pupil apertures at the low brightnesses concerned appear to have been made (with any accuracy) for only comparatively few subjects and even amongst these large variations occur. Reeves (22, Table II, p. 339), Holladay (23, p. 310) and Lythgoe (24, pp. 37-42; Table XIV, 24, p. 75) have published values for seven, three and five subjects respectively. The author has plotted the maximum, average and minimum values* against objective brightness in c./sq. ft. units for each of these groups. (See Figs. 4, 5 and 6 respectively.) (Nutting (25, p. 10), also, has published figures, but he gives only average values and does not state how many subjects were tested. Moreover, he used a method of measurement which is probably not very accurate.) It will be observed that the smallest values of pupil area at low values of brightness for any of the 15 subjects are given by Lythgoe's minimum curve. The author considers that in view of the small number of subjects for whom data are available up to the present the values given by the last mentioned curves should not be considered as abnormal, but as the smallest normal likely to be met with.

It is perhaps worth noting at this point how large a number of factors affect the pupil size of a given individual at any given field brightness. Published accounts of measurements do not always give full particulars of all the experimental conditions and lack of uniformity may account for some of the difference between the results of one observer and another. Moreover, it is always well to keep in mind the conditions under which laboratory work has been done when applying the results to practical problems. For instance, neither Reeves nor Nutting states how great an angle the illuminated surface used in their tests subtended at the eye, and recent work (26, 27) has shown that for at least certain ranges of illumination the pupillary area depends on the apparent size of the surface viewed as well as on the brightness of it. On the other hand, in the work of Lythgoe and of Holladay it is clear that the surface viewed (the inside of an illuminated chamber) completely filled the field of vision. Again, the closing or shading of one eye appreciably affects the pupillary size of the other (22); while the size is also affected by the accommodation or convergence of the eyes (23). Glare in the field of vision causes a reduction of pupil diameter (23; 28. Appendix pp. 59-63), especially for low values of field brightness. Finally, the size of pupil is affected by age and disease and artificially by the use of drugs.

It is also worth bearing in mind that the figures of pupillary size quoted in this paper are based on the diameter of the pupil

* The maximum (or minimum) curve for each group of subjects does not necessarily refer throughout to a particular individual in the group since the individual who has the greatest (or least) pupillary area of the group for one brightness may not have it at another.

ascertained by methods which really measure the image of the pupil formed by the refracting media of the eye, whereas the actual diameter is slightly different from this by an amount which varies with the accommodation. The correction is small and no allowance has been made for it.

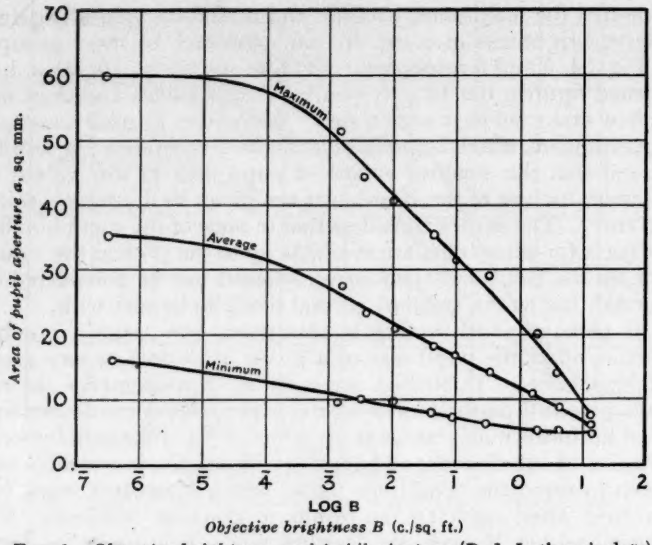

FIG. 6.—*Objective brightness and pupil aperture* (R. J. Lythgoe's data)

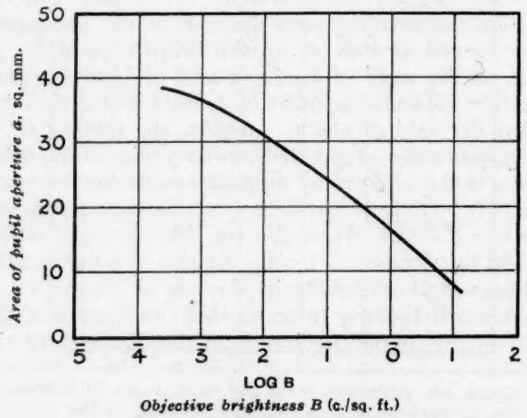

FIG. 7.—*Objective brightness and pupil aperture*
(Average for 15 subjects)

It remains then to determine the value of the objective brightness to give with so small a pupil, as that recorded by Lythgoe, a retinal illumination equal to that produced by a field of 0·004 c./sq. ft. brightness on an "average" eye. It is first necessary to ascertain what this retinal illumination is. For this purpose the author has drawn in Fig. 7 a curve connecting pupil aperture with objective brightness for an "average" pupil based on the average

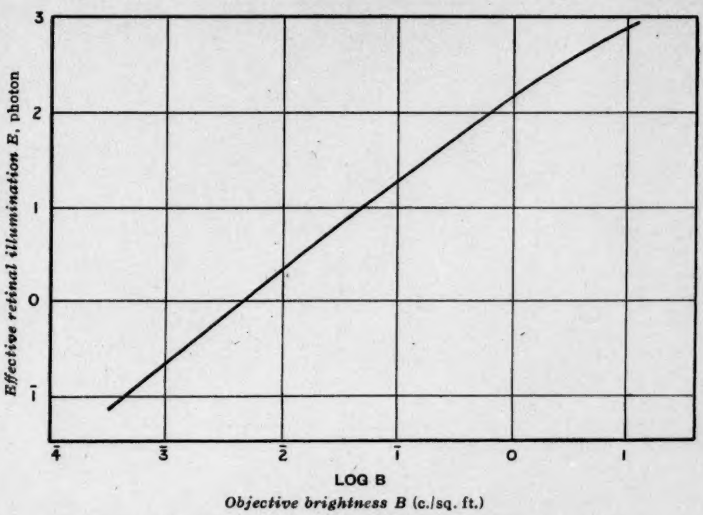

FIG. 8.—*Objective brightness and effective retinal illumination* (Average pupil)

of the three averages of Reeves, Holladay and Lythgoe, duly weighted for the number of subjects tested by each. The effective retinal illumination for such an average pupil corresponding to various values of field brightness has then been plotted (Fig. 8) using the graph in Fig. 7 as a basis. The effective retinal illumination measured in "photons"* is taken to be the product of the field brightness in candles per sq. metre, the corresponding pupillary area in sq. millimetres and the pupil efficiency at that area. (The latter factor has been dealt with by Stiles and Crawford

* This unit was introduced originally by Troland (*b*) in 1916 and defined by him briefly as "the illumination of the retina corresponding with a stimulus—surface brightness of one candle per square metre, and an effective pupillary area of one square millimetre." It is as well to point out that at least three writers have since misleadingly described the photon as the retinal illumination corresponding to a brightness of one millilambert and a pupil area of one square millimetre.

(*b*) Bibliography 30, p. 113 (footnote).
Do. 31, p. 950 (footnote).

(29) in a recent paper where it is shown that the luminous efficiency of rays entering the pupil at different points is not constant, but is greater for rays near the centre than for those near the side. In effect, for instance, a pupil of 50 sq. mm. area is only about half as effective per sq. mm. of area as one of 1 sq. mm. From the published curves the author infers that the relation between

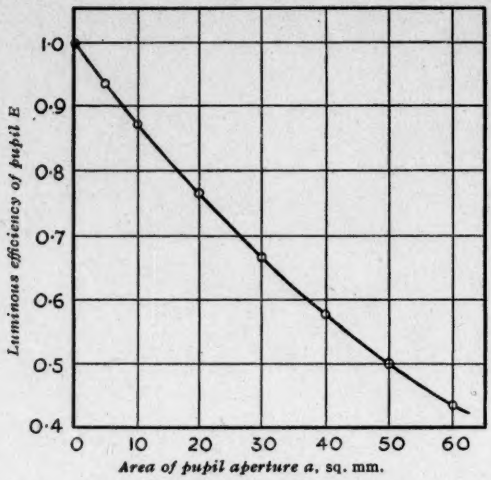

FIG. 9.—*Area of pupil and luminous efficiency*
(Stiles and Crawfords' data)

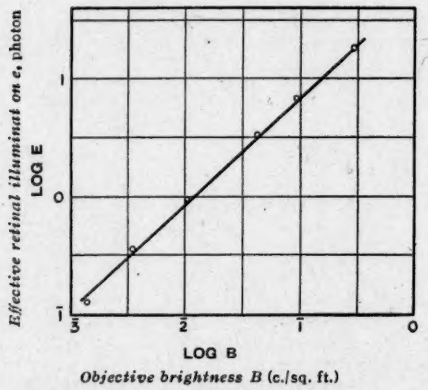

FIG. 10.—*Objective brightness and effective retinal illumination*
(Lythgoe's minimum values of pupil aperture)

the pupil efficiency, E, and pupil area, a (in sq. mm.), is given by the expression

$$\log.10\ E = -0{\cdot}006a.$$

Fig. 9 has been plotted connecting values of E and a, and from this values of E were read off as required for the present purpose.).

From Fig. 8 it is seen that the effective retinal illumination for an average pupil corresponding to a field brightness of 0·004 c./sq. ft. ($\bar{3}$·6 log. c./sq. ft.) is 0·89 photon ($\bar{1}$·95 log. photon). Then, referring to Fig. 10, where is shown a similar curve to Fig. 8, but based on those smallest values of pupil aperture recorded (by Lythgoe) it will be observed that the field brightness necessary to produce a retinal illumination of 0·89 photon is 0·010 c./sq. ft. ($\bar{2}$·0 log. c./sq. ft.).

Hence, if the various assumptions made are accepted, it is clear that to prevent nystagmus the lighting at the coal-face must be arranged to provide a brightness of at least 0·01 c./sq. ft. on the coal surface.

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PART II

Taking an objective brightness of 0·01 c./sq. ft. as the minimum value required to prevent nystagmus, let us see what illumination is necessary to produce this brightness on a coal face.

The reflection factor of coal is very low and it appears difficult to get reliable figures. In the first Report of the Miners' Nystagmus Committee (1, p. 41) it is stated that the amount of light reflected from coal surfaces varies considerably and is from 5 to 16 per cent. of the incident light. Llewellyn (2, p. 72) gives values ranging from 3 to 12 per cent., while Whitaker (3, Table IV, p. 7) gives a value for coal dust of 4 to 5 per cent. In the case of two

pits, Roche (4) states that the light reflected from the "slip" was 15 and 7·5 per cent. respectively. Assuming a figure of 8 per cent. as a working basis which is probably not far from an average value, the necessary illumination required is found* to be 0·4 ft. candle.

This is a considerably higher value than has been advocated up to the present for the purpose of ensuring foveal vision and so preventing nystagmus. Thus, Dr. Roche (4) in 1931 and the Miners' Nystagmus Committee of the Medical Research Council in their Third Report (1932) both give the required illumination as being 0·136 ft. candles, or 0·272 ft. candles for coal surfaces reflecting 10 or 5 per cent. respectively of the incident light.

Turning to the practical question of the provision of a minimum coal-face illumination of 0·4 ft. candles, it is obvious that the luminous output required from any lamp will be largely determined by the area over which the stated illumination must be provided. With a light normally fixed in one position for appreciable periods, such as a miner's hand-lamp or an electric mains lamp, the area to be lit is considerable. It depends on the nature of the work and should include all surfaces or points at which the worker may, or may have to, look with direct vision for the purpose of his work with the exception of long distance glances, *e.g.*, down a roadway. The illumination required can be provided over any area by means of electric lamps run off the mains where such are practicable, or even by stationary battery-fed lamps. It may also be provided by means of electric-pneumatic lamps of approved type driven by compressed air if a supply is available. It is, however, impracticable to provide the illumination by means of any kind of safety hand-lamp. The average distance at which a hand-lamp is placed in practice by a miner from his work is about 4ft. 6ins. (5, p. 156) and at this distance it would require a lamp giving over 8 cp. to illuminate the coal-face to 0·4 ft. candle even at the mere point of the face directly opposite the lamp. To illuminate a circular area of 6ft. diameter (or a rectangular area 6ft. diagonal) on the face so that no part of the area had a less illumination than the figure given would necessitate a lamp giving over 14 cp. The most modern, largest and heaviest electric safety hand-lamps are not even claimed to give more than about 4 cp. in any direction; while the same applies to the latest types of flame safety lamp.

In the case of cap lamps the matter is rather different. The cap lamp moves with the head and need illuminate only that part of the working area which the miner is for the moment facing

* The illumination, E. ft.-candles, required to produce a brightness of B. candles/sq. ft. on a surface of a reflection factor γ is given by the well-known relation

$$E = \pi B/\gamma$$

and within which his direct gaze must for the moment fall. (In addition, it ought to provide "side" illumination of less intensity for peripheral vision. This is referred to more fully below.) It is practicable, therefore, to concentrate the most of the light within a comparatively small angle by means of a polished concave reflector placed at the back of the bulb. It is, of course, possible to provide a reflector for a hand-lamp for use when the lamp is hung up at the working point and some lamps are actually so fitted, but it is obviously not practicable to concentrate the beam so much as in the case of a cap lamp. In such cases the reflector is used more as a shield to prevent glare rather than to concentrate the light. Again, the cap lamp is, at least when used by workers at the coal-face, considerably nearer the work than a hand-lamp would be, and the candle-power required for a given illumination correspondingly less. Unfortunately, it must be admitted that the wearing of a cap lamp and the necessary separate battery becomes a real burden under some mining conditions.

The cap lamp is, then, required to provide the necessary illumination (0·4 ft. c.) at the normal working distance on surfaces and objects only within the maximum solid angle relative to the head over which a man during work normally uses central or foveal vision. Now it is relatively easy to measure the maximum angle for a given head position over which a man *can* direct his eyes. MacMillan gives the figure as approximately 90° (6, p. 257). It is not so easy to say what is the covering angle within which the eyes *are normally* directed during work. The attempt to look directly (even momentarily) at objects at a great angle from the direction in which the head is facing causes strain and, where possible, a person naturally moves the head to avoid such strain. The deviation of direct gaze is thus naturally limited, but the question is, by how much? Some experimental work would appear to require to be done on this point with reference to practical mining conditions where unusual postures and cramped positions will probably affect the matter considerably. Assuming in the absence of definite information that the angle is 30° in all directions from the "straight-ahead" line of vision, that is, a solid angle of 60°, and assuming that the miner is working with his head 2ft. 6ins. from, and directly facing, the coal-face it follows that the lamp is required to illuminate up to the desired intensity an area of the face about 3ft. in diameter.

That modern electric safety cap lamps are capable of such a performance is evident from measurements made in a recent photometric (5, Table I, p. 157) survey of coal-face illumination (to be referred to again later). Two 4-volt cap lamps of the latest type placed 2ft. 6ins. from the face were found to give (as the average of

the two) an illumination of 0·77 ft. c.* on the face at the edge of a 3ft. diameter circle at the centre of which the beam from the lamps was directed. The measurement was made after only two hours' burning and not at the end of a shift when the candle-power of the lamps would be less, due to the voltage drop in the battery, but there would appear to be ample margin to allow for this.

The author would here emphasise the desirability of considering the advocated figure of 0·4 ft.c. as a strictly minimum one to be secured under all conditions and throughout the entire shift. Coal dust on the lamp glasses and in the atmosphere, falling battery voltages, old bulbs, etc., all affect the illumination adversely, and if allowance be made for all the factors involved the figure will probably require to be several times higher under the best conditions.

It may be pointed out here (as already briefly mentioned) that it is not alone sufficient that a cap lamp should provide directly in front of it a circle of light of the brightness and size necessary for unrestricted foveal vision. If the illumination falls off very sharply to zero outside the circle all objects not inside the narrow cone of light at any moment are virtually in darkness and this is undesirable. If the general surroundings underground were of a bright character such objects might be sufficiently illuminated by indirect light reflected off the directly lit area, but in a coal mine where all surfaces are very dark in colour this is not to be expected. The wearer of a cap lamp designed to give a concentrated beam, but with little or no "side" light is thus prevented from using peripheral vision to the full angular extent and cannot see objects at all on one side or another outside the concentrated cone of light without turning his head so that the cap lamp throws light on them. A person normally depends (sub-consciously) on peripheral vision to keep him constantly aware in a general way of objects around him and, particularly, for "picking-up" or "catching sight of" moving objects—for which peripheral vision is specially sensitive. If, then, a miner is denied the use of peripheral vision, except over a limited angle, he becomes subject to danger from moving objects which he cannot see until possibly too late.

The peripheral field of view of a normal individual with the head fixed and the eyes looking straight ahead extends some 100° on either side of the head, or a total angular width of 200°. The total vertical field is about 120° (70° downward and 50° upward). By moving the eyes alone while keeping the head fixed the above angular limits may, of course, be increased.

* The actual published figure given is 0·90 ft. c. but this was measured with the photometer directly facing the lamp. The figure of 0·77 ft. c. given above is corrected for the angle of incidence and gives the illumination on the coal-face itself.

It would appear, then, that an ideal cap lamp should provide a central beam of, say, 60° total width and of an intensity sufficient to illuminate the coal surfaces (at normal distances) to 0·4 ft. candle and, in addition, an outer concentric beam extending to a total width of 200° horizontally and 120° vertically and of considerably less intensity. Even such a lamp would not allow for extreme peripheral vision with the eyes averted from the direct "straight-ahead" position, but such a loss would probably not in practice have any very serious effect on vision or safety. It is interesting to note that the American mining regulations (7) specify a minimum total angle of distribution of 130° for permissible cap lamps, while the author understands that it is proposed to specify a figure of 100° in the new British regulations.

It is of interest to compare with the proposed minimum illumination of 0·4 ft.c. the values actually obtaining in practice as measured photometrically at the coal-face under ordinary working conditions. In Great Britain several such illumination surveys have been carried out in the past and one of the most recent and possibly most comprehensive was the investigation made by Barber, Emmett and Jones (5), some of whose measurements have been quoted above. Their figures are averages for a large number of lamps, usually 100 or more of each type. They measured the illumination on the coal-face opposite the lamp as placed by the miner (on the average 4ft. 6ins. from the coal-face) and at distances up to 4 feet radially outwards along the face. At 4 feet from the centre-point opposite the lamp, the average illuminations range from 0·0005 ft.c.* for old-type oil lamps to 0·034 ft.c.* for modern-type electric hand lamps (excluding a few so-called 6 c.p. alkaline lamps). These figures may best be left to speak for themselves. The average illumination given by 140 2-volt cap lamps was 0·30 ft.c.* measured at a point 1ft. 6ins. outwards along the face from the centre point of the beam opposite the lamps which were placed 2ft. 6ins. from the face. This latter figure is, at least, of the same order as the minimum one herein advocated, and it no doubt explains the well-known fact that in cap lamp mines the rate of incidence of nystagmus is considerably lower than in those mines where safety hand lamps are used. Thus, in Scotland where cap lamps are used to a much greater extent than in England, the percentage number of nystagmus cases is markedly less than in England. Again, in the United States of America cap lamps are almost exclusively used in both gassy and non-gassy coal mines and in that country miners' nystagmus is relatively unknown. Some preliminary figures for a survey of illumination in American coal mines by the United States Bureau of Mines have been given

*After correction for the angle of incidence.

recently in a paper by C. W. Owings (8, Tables III and IV). These figures, which are averages for hundreds of lamps, indicate that with the modern permissible electric cap lamps in use there the illumination on the coal face reaches values of 6·55 ft.c. and 1·64 ft.c. at distances of 2ft. and 4ft. respectively from the lamp, measured in each case at 10° from the axis of the beam. An older type of permissible cap lamp gave 1·05 ft.c. and 0·26 ft.c. for the same respective distances from the face. These figures are not actual measurements of illumination on the coal face, but were obtained by means of a photometer box and illumination meter and are evidently calculated on the inverse-square law. The photometer was used underground.

It may be remarked that there are, of course, other considerations than that of nystagmus to be taken into account when deciding on the minimum intensity of mine lighting and it is not to be inferred that an illumination of 0·4 ft.c. in a coal mine is to be taken as good lighting in an industrial sense. Such is far from the case. To be comparable with modern practice in general industrial lighting the illumination would need to be increased very many times above this figure. An illumination of 0·4 ft.c. on a coal surface of 8 per cent. reflection factor is equivalent in brightness to no more than 0·08 ft.c. on a surface of 40 per cent. factor—a factor much more typical of ordinary normal surroundings. Indeed, if allowance is made in the case of the coal mine for the much smaller percentage of *indirect* light falling on the work, *i.e.*, by double and multiple reflection from the dark surroundings (where white-washing is not applied) the equivalent figure for bright or normal surroundings will be well under 0·08 ft.c. It is hardly necessary to observe that such an illumination would not be tolerated for a moment in even the poorest or most ill-equipped factory or works.

It is, admittedly, very difficult safely to provide adequate illumination in mines, especially gassy mines, and though the recent trend of progress is encouraging, very much remains to be done both from the point of view of improving the miserable conditions under which the miner works and also from that of increasing industrial efficiency—two aims which are by no means unrelated to each other.

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INJURIES OF THE EYE CAUSED BY SPORTS*

BY

STEPHEN DE GRÓSZ

BUDAPEST

WE find numerous relations between the organ of sight and sport. In the first place we may investigate what claims must be laid on the functions of the eye in order to be successful in the various branches of sport. Thus, besides good central vision, great significance must be attached to a free field of vision, good stereoscopic sight and a good light sense. Doyne, whose observations are published in detail in the "American Encyclopedia of Opthalmology," dealt with this question most exhaustively. More recently Sir David Munro gave a valuable review of the significance of the visual factor in sport, with especial regard to flying. Wirgman rendered account of the significance of errors of refraction in rifle practice; and it is conspicuous that two of the five prize-winners had an amblyopic eye. Good centering of glasses is very important. I will mention here that special spectacles are made for the use of marksmen. Another interesting question relates to what branches of sport the various eye patients may follow. In general, we may say that eye patients suffering from inflammatory conditions such as acute catarrh, iritis, etc., individuals inclined to haemorrhage, *e.g.*, Eales's disease, should avoid all branches of physical culture. The highly myopic should also be excluded from sport, because of their tendency to detachment of the retina. We know these facts since Lindner and Rötth made experiments on the phantom. Individuals so inclined may sustain detachment not only through a minor, direct injury to the eye, but also indirectly, from a swift change of position, shock or physical strain.

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In the history of detachment patients, an injury from tennis or football in childhood often plays a rôle. We would not debar glaucoma simplex patients from lighter sports; on the contrary, we may expect certain beneficial results from mild, regular physical exercise (Heiman) naturally, taking each case on its merits.

Along with the spread of hygienic living, the prevalence of sport is taking up greater dimensions from one day to another. We must hail this movement with joy if it really contributes to the improvement of the health of wide circles of the population. However, there is no doubt about the fact that we must qualify record breaking and excessive training as a harmful excrescence, since it produces only single champions and does not serve the purposes of general physical culture. The excessive training of youth might have harmful consequences. In order to avoid this, control by sport doctors is necessary. Parallel with the extension of sport we may expect the increase of sport injuries. To-day there is a separate science on damage caused by sport and this forms one chapter of accident surgery. This article essays to deal with injuries to the eye caused by sport, taking in order the various branches, and particularly emphasising the special injuries. In the same place we shall refer to those cases, which are not injuries in the strict sense of the term, and also to infection.

The eye may be affected directly (mechanically, by radiation) or it may be injured in an indirect manner. The traumata affecting the head may endanger the sight through haemorrhage or fracture, (fracture of the base of the skull or injury of the optic nerve).

This latter possibility exists in every branch of sport, so that in the following we shall discuss the direct injuries. These are generally contusional in character, the mechanism of which I shall not explain here as it is exhaustively discussed in the hand-books of ophthalmology (Kurzes Handbuch der Augenheilkunde; Graefe-Saemisch); perforating injuries are less frequent (ski-staff).

First of all, however, we must digress in the direction of eye glasses. The sportsman wearing spectacles, is, to a certain degree, at a disadvantage with regard to his companions in some branches of sport; thus in swimming and water polo the splashing of the water upon his glasses disturbs his vision while the water may even carry his glasses away. For this reason, some competitors remove their glasses, which naturally is disadvantageous to them. The contact glasses, which in umbral (Zeiss) shade, with a light-absorption of 75 per cent. may be taken into consideration for sport in high altitudes, endeavour to remedy this. These are chiefly advantageous for ametropic sporting people (in tennis, ski and motor sports) as they considerably improve the field of vision (Heine) and cannot be dimmed by vapour. Occasionally people

suffering from a high degree of myopia may use them when bathing. On the rôle of protective glasses we will only say that for adherents to mountaineering, ski and motor sport, and aviation good protective glasses are indispensable since they absorb or rather reflect the harmful ultra-violet rays. On the latter principle is based Imre's reflector, the glass marked gold II and III, which affords first-class protection, especially in the sphere of sport. Protective goggles based upon absorption are the Umbral, with a light absorption of 50 per cent. in summer sports or at the seaside, and of 75 per cent. in high altitude sports, and the Ultrasin N.G. Here I must mention the excellent work of Rugg-Gunn on protective glasses. For tropical aviators he recommends Crookes' B. glasses fitted with a fine aluminium mirror. According to the method of Ritschl (Berlin) the metal is heated in a high vacuum, where it evaporates and is deposited on the lens placed at a distance of 10 centimetres. The glass is of an agreeable, neutral-grey tint and protects from infra-red and ultra-violet rays. On snow-fields he recommends Crookes' B.2, with a gold film made by sputtering, above which there is a covering-glass of uranium. By means of the fluorescence of the latter, by the reflection of the gold layer and the absorption of the glass they afford excellent protection against ultra-violet rays.

Now the problem crops up whether the possible breakage of the glasses serving optical purposes or protective purposes endangers the eye or not. We hear very little of such injuries, but they surely occur, and it certainly lends a feeling of security if sporting people have their glasses made of the so-called unbreakable glass, which does not break to splinters but merely cracks. If a layer of cellulose acetate, the refraction of which is nearly identical with that of glass, is placed between two lenses and then pressure and heat are applied we get the so-called unbreakable or laminated glass (Triplex, Splinter Proof, etc.). This can be made in such a way as to be merely 0·5 mm. thicker than the corresponding common corrective glass. One layer acts as a "shock absorber" for the other, thus this glass is much more resilient than common glass. In case of an accident the two lenses hold each other and the splinters remain together. There is also a secret process for colouring them. This is an important invention—especially for golfers, aviators, motorists and other sporting people and especially for children! Such is Hamblin's Salvoc glass, also the French "aclastos," introduced by Bichelonne. To-day, faultless optical corrections and tints are manufactured. It is important that the frame and the glass should secure a wide field of vision for the player (Perivist Zeiss, Full Field Hamblin, principally in relation to tennis). Expressly for sport are made Hamblin's sport spectacles and Keeler's folding Perimet sport glasses and for ski-ing Hamblin's Everest goggles.

Motor sport.—Besides the indirect injuries caused by motor accidents, lesions of the optic and the oculo-motor nerves caused by skull fractures, the glass splinters of the car also endanger the eye and its surroundings. The perforating injury of the eye-ball with all its consequences, bleeding, cataract, infection, does not belong to the rarities. In the case mentioned by Morax enophthalmos followed the accident. As accidents happen on the high-road, it is necessary to give a preventive tetanus anti-toxin inoculation, even if the eye only is injured (2,500 units). Since in cases of injuries from broken car windows the danger of gas-gangrene is great, it is advisable to supplement the former inoculation with gas-gangrene serum, *e.g.*, I.G. Farben's Anaerobic serum* (Prophylactically 10-20 cm.,^{3} therapeutically 100 cm.^{3} intra-muscularly). We have not yet been able to demonstrate the intra-ocular glass splinter; Beauvieux succeeded in doing so on X-ray plates with soft rays. We must know, furthermore, that the lens fluoresces in ultra-violet light, but the glass splinter in it does not; therefore in this place we get a defect (Kleefeld). It is desirable that the wind-screen should be made of Triplex. A slight extra outlay upon the glass would prevent many injuries.

Among the ophthalmological relations of motor accidents, we may mention Rollet's two interesting cases. As the cause of repeated serious accidents in the evening he was able to demonstrate that the motor-bus drivers suffered from hemeralopia with intact fundus. According to police statistics, most accidents happen in the twilight. According to Rollet, the greater traffic and hurry to be expected at this time afford no explanation of this fact. Here the deficient vision, which presents itself in weak lighting, must play a rôle, and also the question of how soon sight returns after the glare caused by head-lights. Therefore Rollet demands that the drivers of fast vehicles (motor-buses, trains, aeroplanes) should be subjected to a preliminary photometric examination, as well as those causing evening accidents, especially in police cases. Those suffering from disturbed colour perception, on the other hand, are apt to mistake the signs of the municipal traffic lights. Accidents in the night are due to the oncoming chauffeur's not extinguishing the head-lights, thereby dazzling the other. In one of Rollet's cases the dazzled motorist ran into a tree and the splinters of the wind-screen cleft his eye in two; it was necessary to perform primary enucleation. Therefore it is advisable for drivers to wear Zeiss motoring-glasses in which there is an umbral layer thinning from above downwards so that when driving they can protect their eyes from being dazzled by the oncoming light by simply bending the head forward; at the top,

* A combination of antitetanic and anaerobic sera.

the glasses have an absorption of 95 per cent. The measurements in connection with this were made by Hartinger and Fertsch from the standpoint of relative glare. Kühl confirmed these investigations; he found that in case of glare (Blendung, Uberstrahlung) the momentary use of light-moderating glasses is advisable.

At the session of the Belgian Ophthalmological Society, Bichelonne and his co-workers recommended yellow light for reflectors, *i.e.*, cadmium glass, the advantages of which are: heightening of contrast, sharper sight, better distinguishing capacity and less fatigue. For motor-car drivers it has the following advantages: less glare, shorter re-adaptation and shortened time of psychomotoric reaction. Blondel also recommends reflectors with yellow light with sulphur-cadmium-selenite glass of 0·3-0·5 mm. in thickness, from which electric-light bulbs may also be made. All the rays of light can be excluded under 520$\mu\mu$.

By excluding the very disturbing blue and violet rays reflected from the water drops in rain and fog, this light signifies a very great advantage. These same rays cause the glare also. With yellow light re-adaptation is quicker and there is a smaller reduction of visual purple. Besides this we may expect a better eyesight than with white light (monochromatic, 600$\mu\mu$). Eye-glasses made of a similar glass would not be suitable.

Cazeneuve and his colleagues have called attention to a very interesting cause of motor accidents. On examining 2,000 chauffeurs they found a difference of the pupils which is easily demonstrated if the patient fixes his sight first on a light point and then on a dark one. Generally the left pupil was more dilated. They also brought about anisocoria experimentally. The effect is believed to be due to the oil vapours, the exhaust gas, and chiefly the penetrating CO which may easily cause intoxication in a closed car. Knowledge of these phenomena is derived from war-time cases after a long motor transport. Anisocoria is brought about more easily in cases of alcoholism. The medullary centres form the point of attack; the result of the blood examination, and the blood pressure were normal. The Wassermann test was negative. In the case of three chauffeurs when the accidents were attributed to drunkenness (dizziness, diplopia) CO was demonstrated in the closed car. The loss of consciousness was due to this. However, anisocoria is a suitable symptom for the detection of these sensitive individuals. In doubtful cases, of course, the examination of the alcohol or the CO content of the blood would be the decisive factor. Bad ventilation, incorrect construction or a faulty gas-exhaust may be the causes of such poisoning.

Game shooting often causes eye injuries, seldom by the explosion of the gun but rather owing to the projectile, either directly or by ricochetting. Such injuries are well-known, therefore particulars

are superfluous here. We merely wish to call attention to the early and exact localisation of the foreign body (Sweet) which, from the standpoint of the prognosis and operation, is of decisive importance. We may expect the reduction of these rather frequent accidents caused chiefly by small-shot, from the strengthening of sport discipline.

Angling is perhaps one of the most innocent pastimes. Nevertheless, we are acquainted with exceptional accidents here also, which we shall speak of more fully since they are not very common.

Hauptvogel, in 1923, mentioned a case at the Elschnig clinic, where the hook with the worm attached went through the limbus into the anterior chamber and entered the iris. By widening the entrance-opening with a Graefe knife the hook was successfully removed. The patient, a boy, aged 10 years, left the clinic with posterior synechia and 5/10 vision. In the same year Hermann treated a similar injury at Worms. The hook, which was cast a few metres away from the patient by his fishing companion, went through the cornea and the iris and buried its point in the lens. The longer branch of the hook, together with the bait, stuck in the palpebral aperture. Widening the wound with a lancet the hook was removed, nipping off the part of the iris which had become entangled therein. The conjunctiva was pulled over the wound. The patient left the clinic with traumatic cataract and 5/7 vision. The other eye was amblyopic. In the case of Clarke, the hook, penetrating through the limbus, perforated the iris in two places, and its point stuck in the lens. The aqueous humour flowed out; the wound was enlarged and iridectomy performed. Owing to cataract caused by injury a discission was made (Queen's Hospital, Honolulu), and later the capsule was removed. With complete correction unimpaired conditions resulted. In one of Villard's eight cases a trout angler completely split his own cornea. In two of Borel's cases he could only remove the hook by cutting off the "harpoon" with watch-maker's clippers.

It is conspicuous that the above described cases proceeded without serious infection, though the nature of the injury renders infection probable. Prophylactic injection of tetanus antitoxin is advisable.

Probably the example of surgeons should be followed, who usually push the point through and clipping off the harpoon disengage the hook without much injury to the tissues. In our experiments on the pig's eye we pushed the point through the cornea after having made a small incision. We are convinced that this method inflicts the least injury.

The characteristic sport-complaint of *alpine tourists* is snow blindness, which is caused by the dense ultra-violet radiation reflected from the snow and ice-fields. Its slighter form shows

lacrimation, photophobia, blepharospasm and irritation of the conjunctiva. The serious form shows excoriation of the cornea corresponding to the palpebral aperture. To avoid such painful phenomena, protective glasses are necessary (see above). This condition is identical with ophthalmia photo-electrica, to which welders and film actors are subject; treatment comprises: cool compresses, adrenaline and possibly dionine. I do not like to order cocaine because of its drying effect, and instead recommend 5 per cent. novocaine-adrenaline or psicaine ointment as a remedy against the tormenting symptoms. Aqua zeozoni and corodenin drops are ineffective from the standpoint of light protection. Recently didymium ointment was recommended. According to Hess the harmful effect of light on snowfields is in connection with the thick layer of ozone extending over the high mountains, which layers select the harmful wave-lengths by way of diffraction.

Strebel has written on the eye injuries caused by ski-ing. He had many cases in Lucerne. We shall speak of his experiences in the following. The classical ski-staff injury of the eye is the contusion and rupture of the tendons, in the first place, of the inferior oblique which is always accompanied by permanent paralysis. Contusion of the external rectus with subconjunctival haemorrhage and concussion of the retina are frequent. The alarming diplopia, however, ceases in a short time. The situation is graver in the case of skull fractures, or the tearing of the periosteum and Tenon's fascia; for in such cases a cicatricial contracture arises which imitates the paralysis of the rectus externus. When the scar is freed the pseudoparesis ceases. This happens in cases of injuries to the inner canthus when, owing to the tearing of the canaliculi, permanent epiphora (with chronic catarrh) may ensue. If the tangential effect is stronger, the sinuses may be opened, sinusitis, fracture of the base, meningitis, and in case of a severer trauma, evulsion of the optic nerve may ensue. Finally, with a component rotating outwardly, a dislocation of the eyeball may occur while the edge of the optic foramen saws off the optic nerve. In a case of falling directly on the point of the staff the eyeball ruptured. According to Strebel, the great fault of the ski staffs is their being too long. In Switzerland they are 1·15 metres in length and in Austria 2·10 metres, and their not being padded is also a source of danger. Therefore he demands that the end of every staff should be covered with a leather cushion fixed through the strap bore, thereby securing the upper point of cleavage. The staffs with wooden buttons may easily cause rupture of the eye. His second demand is that the staff should be as short as possible and should at most reach the armpit when sliding. The long form should only be allowed for special cases, such as long distance running, military ski patrol; for beginners such

staffs are dangerous. He recommends staffs the size of a walking stick. We can identify ourselves with the first demand, but not with the second, because the short staffs may also cause injury: slipping when going up inclines and also the sportsman would not dispense with the indubitable advantages of the long staff. Herrenschwand (Innsbruck), whose views are similar to ours, attributes a rôle to the thickness of the staff; the thin and light hazelwood staffs (chiefly used for children) may cause a deep penetrating wound. It is advisable when sliding down hill, not to twist the strap around the wrist but to hold it freely, possibly with outstretched arm in a backward direction. In this manner we may avoid the characteristic distortions of the metacarpo-phalangeal joint of the thumb, as well as abdominal and face injuries, because, when falling, the staff is dropped. The habit of beginners, arising from a feeling of insecurity, to hold the staffs in front of them with bent arm, is dangerous. In alpine tours the ski staffs equipped with a pickaxe may also cause trouble. Strebel recommends that when crossing glaciers (with ropes) the point of the pickaxe should be wrapped up in a ski-stocking lined with straw when not in use. Even better would be a pickaxe which can be screwed off and placed in the knapsack. In one case the pickaxe caused a rupture of the choroid. A further possibility is to fall on to the point of the skis, therefore the desire that the ski should reach above the outstretched arm is correct, in other words, skis should be chosen individually. For the person taller than normal, the accustomed length may be relatively short. If the ski is suddenly arrested in course of the slide by obstruction in the ground or some fault the body is thrown forward and the end of the skis may easily be buried in the face of the runner. In one case it injured the orbit through the upper eyelid, causing prolapse of orbital fat.

The injuries discussed hitherto may be called typical. Herrenschwand communicates seven interesting cases; besides these, naturally, the eye may be injured in other winter sports, such as tobogganing. To this category belong injuries caused by the breaking of branches of trees and sport-equipment, which do not belong to the speciality of the branch of sport in question, but may occur in every sport which necessitates motion. We say that padding the handle of the staff is proper and should be insisted upon, but even this is no security against accidents. Even the most skilful sportsman may fall into a situation when the staff may endanger his face and this cannot even be avoided, because very often the defensive reflex brings it about in quickly changing positions. Owing to the great number of the components playing a rôle in accidents, it can hardly be expected that the carrying out of the staff reform demanded by Strebel would render this

sport essentially less dangerous. Perhaps suitable training would be beneficial from this standpoint.

On *sleigh sport* (toboggan, bobsleigh) I will only say that these may bring about indirect injuries, particularly injuries of the head, chiefly by running into trees; from this standpoint the skeleton sleigh is the most dangerous, where the sportsman lies face downwards with head in front. Injuries to the forehead or temples "par contrecoup" may lead to injuries of the optic nerve.

The forms of *football* injuries are the following: slight contusions causing bleeding in the anterior chamber; this heals quickly. Graver possibilities are intra-ocular bleeding, sub-luxation of the lens, traumatic cataract or detachment of the retina. The ball may cause the type of injury which ensues from collision with blunt objects.

In two cases Professor Gérard saw hyphaema; in a third the traumatic cataract led to secondary glaucoma, therefore he removed the lens. Later on the hard bloodstained eye had to be enucleated. This author, in his exceptionally interesting article entitled "L'oeil et le sport," strongly reproves sport excesses. We have seen an injury of easy progress from the breaking of eyeglasses: a young myopic physician wearing concave glasses while playing football, the ball broke his glasses; extensive lacerations of the lid was the result with slight corneal abrasion. Gérard also dealt with tennis-ball injuries. Besides simple contusion he saw choroido-retinal rupture and haemorrhage into the vitreous, and in one case detachment of the retina. In general, with football the danger is less owing to the size of the ball than with tennis for the bony edge of the orbit prevents deep penetration. A young professional's right eye was hit with a football; his eyesight became bad immediately. There was haemorrhage in the vitreous and at the posterior pole, retinal and preretinal haemorrhages extending to the periphery were seen. Between the blood-spots of the retina bluish-white areas were to be seen (traumatic oedema). After a week the haemorrhages in the vitreous disappeared, while those of the retina showed a diminishing tendency.

The injuries caused by tennis balls are: suffusion of the subconjunctiva, abrasion of the cornea, hyphaema, rupture of the iris and choroid, and even rupture of the eye-ball. Fejér, at the 24th Congress of the Hungarian Society of Ophthalmology, referred to a case of recurrent keratitis, and further two cases of injuries causing a fissure of the iris and rupture of the choroid. Fazakas saw concussion of the retina arise, against which he recommends inhalation of amyl nitrite. Tóth saw lesions of the corneal epithelium and Ditrói central scotoma with photopsia.

The player standing by the net doubtless is more exposed to injury.

Thus extensive abrasion of the epithelium of the cornea and serious internal haemorrhage occur in some cases. The former cases generally regenerate quickly and the latter are quickly absorbed. A few of our cases: 1. A man wearing concave glasses was injured by a tennis ball so that the glass broke and its splinters caused a perforating trauma to the cornea pinching in the iris, which was released in course of the recovery. Three weeks afterwards the wound was healed, leaving a scar and a round pupil. This was a rare and fortunate accident. 2. A swift ball hit the player in the right eye causing extensive abrasion of the cornea. Cured in one week. 3. In another of our cases the ball caused intra-ocular bleeding, this, increasing, developed into glaucoma. The blood was absorbed without interference.

We believe it probable that the cause of contusional deterioration of sight is concussion of the retina and perhaps we should see more often traumatic oedema of the retina if the examination of the injured person could be effected immediately. From the standpoint of the eye the most dangerous sport is *boxing*. The especially frequent cases of haematoma of the eyelids and haemorrhage under the conjunctiva are of no consequence, for in spite of their alarming appearance they heal quickly. If accompanied by fracture, subcutaneous emphysema occurs which increases on blowing the nose. The fissure of the skin of the eyelid along the orbital bone is frequent, on which occasion the entire eyelid may tear off. It is of graver consequence if a cataract arises, without opening the eyeball, or detachment of the retina occurs.

Sedan describes the following conditions in four professionals (three champions). Very sluggish photomotor reflex, deformed pupils, mydriasis, the cause of which are the fine ruptures of the stroma extending to the lacunae sometimes with irido-dialysis. He believes it to be a characteristic occupational disease after several years in the ring. With another boxer he found permanent exophoria, mydriasis and sluggish reflexes. Still one other after fracture of the skull had rupture of the sphincter of the iris, with deformed pupils and complete absence of reflexes. Syphilis, of course, was excluded. A third had similar changes of the iris accompanied by detachment of the retina. Jokl and Guttmann, in their interesting compilation which deals with the neurological examination of boxers, mention temporary paralysis of the ocular muscles among the direct consequences, headache, disturbance of speech, etc.

With regard to *fencing* we have little to say. The faultless mask, the foil with a button, all afford sure protection for the face of the fencer. Yet a few cases are known when the foil, making an aperture in the mask, has run through the eye, or leaving the eye-ball intact has run beside it, backwards into the

orbit, cutting through the optic nerve in its depths causing primary atrophy of same (Emil de Grósz, Kretz). By penetrating through the top of the orbit it may even injure the brain. In such cases the button also breaks on the mask. King Henry II of France died in a similar manner in 1559, when he fought in a tournament, "la joute," on horseback, with a lance against Montgomery.

In the sphere of *water sport* (swimming, rowing, water polo) we do not find any particulars regarding injury to the eye. The catarrh of the conjunctiva sustained in closed swimming pools is probably due to a filterable virus and is of genital origin. The unilateral acute follicular conjunctivitis, accompanied by pre-auricular lymphadenitis, has proved itself to be an exceptionally obstinate disease, which only improves after long treatment, though it has no serious consequences. This fact distinguishes it from trachoma. This disease, belonging to the group of inclusional conjunctivitis, frightens many people away from closed swimming pools. Only the daily changing of the water or treatment with chlorine could dispel this certainly justifiable fear. In this direction a great future awaits oligodynamic silver which sterilises in minute quantities (katadyn process).

A unique injury caused by a *golf club* was described by Morax at one of the sessions of the French Society of Ophthalmologists. On the fundus of the blind eye situated in the depths of the orbit there were extensive haemorrhages and much depigmentation.

The general frequency of trauma in *hockey* is 33 per cent. (Glass). The special injuries are caused by the stick, 37 per cent., and the ball, 43 per cent., the remainder belong to the indirect group (falling), 43-46 per cent. of the injuries are to the head; most frequently the surroundings of the eyebrow. In the injury of the latter the stick plays a rôle of 17 per cent., the ball 26 per cent. (bruises and cuts). Anyhow, the injuries are chiefly to the soft parts so that the player is soon able to return to his sport.

Owing to its beneficial effect upon physical culture and to the fact that it incurs little danger, Arnold believes hockey to be a branch of sport to be recommended from a sport-medical stand-point.

We have been informed of a quite extraordinary trachoma epidemic in the United States. Patton and Gifford treated eight wrestlers from Omaha who caught trachoma from each other while *wrestling*. From the anamneses the succession of the passing of the inoculation was precisely established. According to the explanation of the professional heavy-weight champions and the ex-champions, during the bout, when the referee was not looking, they vigorously massaged each other's eyes according to ancient custom, the aim of which was to bring about Ashner's oculo-cardiac reflex.

To bring about this reflex we press the eye-ball with eyelids closed for 10 seconds upon which, in case of excessive excitability of the vagus, bradycardia occurs, when, in certain cases, the pulse stops for a few seconds. A positive reflex signifies lability of the pneumogastric and has the same effect as carotid sinus-pressure (Hering). It may be used to stop paroxysmal tachycardia. In order to study the oculocardiac reflex Pruche made an electro-cardiogram. He found that not only the frequency of auricular and ventricular contractions changed, but that the electro-cardiographic appearance of several cardiac revolutions was altered (shortening of the PR complex, auricular-ventricular dissociation, etc.). Complete heart block may also occur.

In the meantime they infected each other's eyes with the virus of trachoma by means of perspiration. After being enlightened the wrestlers were willing to warn their antagonists of this and to join forces in the campaign against the infection. According to Patton, they were, without exception, "a splendid bunch of fellows." Darier mentions three similar infections from Paris, which occurred in course of a wrestling match. He believes that the wrestler, suffering from trachoma, wipes the tears and the mucus out of his eyes, in the heat of combat, with his fingers, thus spreading the contagion to his adversary. Zentmayer saw two similar cases in Philadelphia: an amateur and a professional. MacCallan, in his presidential address in London, May, 1935, stated: "It is not generally known that nearly all professional wrestlers have trachoma." He thinks that Rugby football is able to disseminate this infection if a member of the team is infected.

Of the numerous varieties of *athletics*, spear-throwing is the only one which I wish to mention. In Schneider's case the spear, thrown from behind, struck the person in question just as he was turning round. It penetrated the corner of the eye, tearing off the rectus internus, causing a rupture of the choroid. Three months later a brain abscess developed, which healed after operation. Thus the spear caused a stab on the brain through the dura as well as injuring the wall of the frontal sinus.

The *Sandow*, which used to be popular a few decades ago, and is still cultivated, also takes its victims. A young man with his foot in the expander was practising the exercise of stretching the spring. The handle slipped off his foot and flew into his face in such an unfortunate manner that it caused partial disinsertion of the iris and traumatic cataract with complete deterioration of sight (Villard).

In a similar case of Gérard the eye of a young girl had to be removed owing to rupture of the eye-ball. In another case haemorrhage into the vitreous occurred through the breakage of the elastic band and the instrument flying into the patient's face. In every

one of these three cases, one handle was in the hand and the foot was placed in the other. The slipping of the handle or a broken spring caused these grave injuries.

A short time ago we had the occasion to see an extraordinarily rare accident in *skating* (Horay). A seven-year-old girl fell on the ice in such a manner that the skate tore her eye. The bleeding uvea prolapsed through a sharp-edged wound about 2cm. in length running through the cornea on to the sclera. We had to enucleate the collapsed eye-ball. Here we must mention that the same may be said of *ice hockey* in general as of grass hockey with the exception that in place of the flying ball the disc, sliding along the ice, cannot so easily cause trouble. On the other hand, the greater speed attained by the player causes more falls and collisions, thereby carrying indirect injuries in its train. In one case the disc striking the player in the eye caused a retention cyst lined with stratified cylindrical epithelium in the lower fornix, which arose from the piece of epithelium torn off by the blow and inoculated beneath the conjunctiva (Panneton). A boy of 17 years was struck by his own stick through an inadvertent movement of a fellow-player. On examination there was an extensive corneal abrasion, traumatic iridoplegia and hyphaema. The slight protrusion of the eye-ball suggested retrobulbar haemorrhage. The initial rise of tension subsided spontaneously and full recovery took place in three weeks.

I wish to communicate an injury caused by an *arrow*. A schoolteacher, 20 years of age, was wounded in the eye by an arrow which his companion shot by accident from a distance of 12 metres. A long wound was caused in the suffused lower eyelid, a lacerated wound of 1 cm. within and under the conjunctiva and an unequally deep anterior chamber, iridodonesis, subluxation of the lens. Three days after the injury the hyphaema of 1 mm., which appeared on the following day, was completely absorbed; there was slight trembling of the iris with normal tension.

In the course of the Franco-German *Rugby* match played at Budapest International Olympic Games for Students, 1935, a German player was accidentally struck in the right eye by an opponent, causing the outer canthus to split and a contused wound 2 cm. in length on the conjunctiva. The wounds healed *per primam* after suturing, but the tearing of the rectus externus caused permanent paralysis of the muscle. Later on advancement of the muscle will be performed.

I saw emphysema of the orbit arise in the case of a young girl during a "friendly" *basket ball* match. She was struck in the face by her opponent. On the X-ray picture one can easily discern the air in the orbit and a linear fracture of the lamina papyracea. The eye-ball was intact.

If we peruse the described sport injuries, we must say that some of these are rare contingencies, even curiosities such as occur in angling and Sandow, but some of them are typical occurrences with which we must reckon (boxing, ski). The question is whether they are avoidable or not. Alas, only partially. The protection against excessive light in high altitudes has already sunk into public knowledge. The number of infections in closed swimming pools, including aural infections, can be reduced by stricter control of the water. We have discussed in detail the manner of protection in ski sport. There would be one more possibility to diminish the number of accidents, *i.e.*, increased sport discipline, which, for instance, would reduce the number of hunting accidents. And here belongs the problem of sport training also.

I hope that by writing these lines I shall succeed in awakening the interest of ophthalmological and sport-medical circles in a somewhat neglected sphere. The outlining of sport injuries can only be an advantage to physical culture since by knowing them they can be avoided, if only partially. This work serves this purpose.

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A CASE OF SECONDARY HAEMORRHAGE FOLLOWING CURETTAGE OF MEIBOMIAN CYST

BY

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WE believe this case to be worth reporting owing to the extreme rarity of the emergency which arose. We can find only one reference to such an occurrence, this being, unfortunately unobtainable in this country:[1] and on enquiry at Moorfields the condition was apparently unheard of except for one instance. We shall refer to this in the course of the report.

The patient was an American girl, aged 23 years who was touring England for her health after a 'nervous breakdown.' She consulted Mr. J. G. D. Currie, in August last year for what amounted literally to a crop of Meibomian cysts, nine of them distributed over the four eyelids. She gave a history of having had one similar cyst curetted in America in the right lower lid.

She refused any form of procedure under local anaesthesia, and consequently, rather against his wishes, Mr. Currie consented to curette them all at one sitting under general anaesthesia.

This was on August 3. Recovery from the anaesthetic was uneventful: reaction in the lids was trifling, and all the cysts appeared to be following the normal course of healing by second intention.

On August 7 at 3 a.m. her parents telephoned to the effect that there was some bleeding from the right eye; the magnitude of this not being considered serious she was advised to try pressure on the lids for a time. An hour later she was brought to our consulting rooms with two face towels wrapped round her head, both copiously soaked in blood.

On examination there was seen a definite spurting artery. All attempts to arrest this on the spot failed; mainly owing to the patient's great sensitivity and nervousness.

She was removed to a nursing home forthwith. Here, after injecting a little novocaine—adrenalin, it was found possible to get a satisfactory view of the lid. The offending cyst was in the centre of the right lower lid, gaping open with sloughy-looking edges, and filled with blood clot. There was now no haemorrhage at all.

An 000 silk suture was passed twice right through the thickness of the lid, just to the basal side of the cyst, and tied over a small rubber tube on the skin.

There was no further haemorrhage, and the patient was returned to bed. She was somewhat blanched, but the pulse rate was 80 only and of good volume.

It was now discovered that the patient had been suffering from whooping cough for a few days, and it was thought that this might have been an exciting cause of the haemorrhage. It was also mentioned by the parents at this stage that the cyst from which the haemorrhage had occurred, corresponded in site to the one which had been previously curetted.

For forty-eight hours all went well, the suture being well tolerated, with very little local reaction or swelling. The whooping cough was only moderately controlled by sedatives.

Forty-eight hours after the first suture profuse haemorrhage commenced again. It was practically uncontrolled by adrenalin pack and pressure dressing, rapidly soaking through the latter. A complete blood investigation showed no trace of any abnormality, apart from slight anaemia of secondary type. The liver and spleen were of normal size and coagulation and bleeding times were normal.

The patient was given a general anaesthetic, with a view to more extensive suture. On arrival on the table the bleeding had ceased, and did not re-start on taking out the previous suture. Three 000 silk sutures were passed right round the cyst and tied firmly. The patient was kept on the table for an hour, but no further bleeding was observed. Her pulse was 90.

There was no further bleeding and the sutures were removed on the fifth day. At this time the lid was still rather swollen and discoloured, and an acute Meibomian abcess of the small marginal type was found just external to the haemorrhagic one.

This was squeezed out and the whole lid was rapidly approaching normal when we last saw her three weeks after the first haemorrhage, when she was about to make the journey home.

Comment

As mentioned at the start, we believe this condition to be extremely rare, though we can see no reason why secondary haemorrhage is unusual as a sequel of the procedure, as the requisite infective process is present in the cyst, and also frequently in the conjunctival sac.

The first suture was presumably ineffective after a time, as, being two to three mm. away from the bleeding point, it failed to compress the vessel as the local swelling subsided.

An alternative method suggested by Mr. A. H. Briggs[2] and used by him in his recent case, would have been to suture the palpebral conjunctiva tightly over the cyst. This was success-

ful, but resulted in extensive ecchymosis. Perhaps the most certain method of arresting such a haemorrhage is that adopted by the writer, namely, the passing of a suture round the cyst itself; certainly no ill effect was observed from this.

Finally, it is interesting to speculate as to how far the presence of pertussis was a contributory factor.

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A CASE OF ACUTE UNILATERAL RETRO-BULBAR NEURITIS ASSOCIATED WITH NASAL-SINUS DISEASE

BY

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LIONEL COLLEDGE *and* H. GRAHAM HODGSON, C.V.O.

LONDON

Introduction. (R.R.J.)

RETRO-BULBAR neuritis, due to nasal sinusitis, is probably much less common than was formerly thought. It is true that a retro-bulbar neuritis may occasionally be due to absorption from some septic focus. I have seen such a case in a patient with severe dental sepsis. The eye condition ran an acute course, was bilateral and cleared up completely in about four months' time.

In my early days at St. George's Hospital I saw a chronic type of case. Mr. Harold Barwell found evidence of nasal sinus trouble; the man was operated on and went out with much improved vision. A few years later the condition recurred and the patient was sent to Mr. J. B. Lawford who wrote to me for the notes of the case. In writing to thank me for them Mr. Lawford told me that, on reviewing the case, he had come to the conclusion that the ocular condition was entirely due to tobacco!

The case which we now report would seem to be of some rarity.

The Nasal History. (SIR STC. T.)

The patient first came under observation in 1930 with evidence of suppuration in the left maxillary sinus. He was then 72 years of age and, being averse from a larger operation, the sinus was simply drained through an opening in an empty molar socket.

THE LEFT OBLIQUE VIEW.

The posterior ethmoidal cells are blurred and ill defined as the result of infection. One of these cells is indicated by arrows and contains a small amount of fluid.

MENTO-VERTICAL VIEW.

Showing a fluid level in the left sphenoidal sinus.

This gave so much relief that he was not seen for two years. In May, 1932, he returned to say that the rubber obturator in this molar socket had been worn too long and that, the flange having perished, it had slipped into the cavity of the antrum! An X-ray plate demonstrated this and also showed some thickening of the mucosa and some cloudiness of the left frontal sinus. The other sinuses were then clear. It was therefore decided to operate on the maxillary sinus and an endo-nasal operation was performed on May 2, 1932.

All symptoms disappeared except an occasional discharge of muco-pus from the region of the left frontal sinus and the patient was not seen from December, 1932 until he was referred to me on May 10, 1933, by Mr. R. R. James with the symptoms elsewhere described.

The Ophthalmological History. (R.R.J.)

A medical man, aged 75 years, who had previously attended for change of glasses and mild attacks of conjunctivitis since 1923, called on May 8, 1933.

Up to this date the vision, after correction of a small amount of compound hypermetropic astigmatism, had been 6/6 and Jaeger 1. in each eye.

The recent history was that he had woken up on May 7 to find the sight of the left eye blurred. There was also some pain on movement of the globe.

The right eye was normal in every respect, with 6/6 vision after correction.

The pupil reaction to light on the left side was extremely sluggish; tension was normal; vision, only hand movements.

After dilating the pupil the following note was made. "Lens and vitreous clear, disc flat. No haemorrhage present." The field was full save for a slight contraction, in the upper nasal quadrant, and there was a large central scotoma.

The blood pressure was reported as 200/110.

There was a history of previous antral trouble on the left side, for which Sir StClair Thomson had performed a radical operation a few years before, with excellent results. *Vide supra.*

Sir StClair saw the patient and reported a clear left frontal sinus; the left antrum was washed out and only a tiny spot of mucus resulted.

Dr. Graham Hodgson saw the patient on May 11 and his report was in our hands early on May 12. The following is a copy.

"All radiograms were taken in the erect position.

There is thickening of the lining membrane in the left antrum and in the left frontal sinus and left ethmoid cells and also to a

slight extent in the right frontal sinus and right anterior ethmoid cells. The right antrum is radiologically normal.

The posterior ethmoid cells on both sides show thickening of the lining membrane, which is more marked on the left side than on the right. At the time of the examination some fluid, the level indicated by arrows, was present in one of the left posterior ethmoid cells.

Both sphenoidal sinuses show thickening of the lining membrane, this being more marked in the left sphenoidal sinus than in the right, and in the left sphenoidal sinus at the time of the examination, a fluid level, also indicated by arrows, was present."

The deterioration of vision was very rapid. On the morning of May 12 the eye was practically blind. The pupil hardly acted to light, only bare perception of light was present and no field could be charted. The left disc was swollen 1.0 D. and the vessels were slightly turgid.

Sir StClair Thomson strongly advised immediate operation and that afternoon Mr. Colledge opened and drained the left sphenoidal and ethmoidal cells.

The following are his remarks :—

This patient was sent to me by Sir StClair Thomson with the history so carefully detailed by Mr. James. Under cocaine and adrenalin anaesthesia there was visible a pulsating spot of light on the purulent discharge in the neighbourhood of the ostium of the sphenoidal sinus, resembling the pulsating spot often seen in the neighbourhood of a perforation in the tympanic membrane when drainage is insufficient. With Hajek's forceps the anterior wall of the sphenoidal sinus was cut away and some posterior ethmoidal cells opened. Complete healing took place and all discharge from the nose ceased after a few applications of argyrol. A large opening remains into the sphenoidal sinus.

Unfortunately, although the operation was done within five days of the time when symptoms first declared themselves, no improvement in vision resulted. The damage was apparently due to a direct spread through the wall of the sinus into the optic nerve.

Although this route of infection is well-known, it seems actually to be rare, and the great majority of cases of retro-bulbar neuritis, referred for examination, prove to be early cases of disseminated sclerosis or, sometimes, tobacco amblyopia. In a few cases infection of the tonsils or accessory sinuses acts as an area of focal sepsis. Direct extension as in this case is rare and it no doubt accounted for the symptom of pain on movement of the eye.

Another interesting feature of the case was the clear demonstration by Dr. Graham Hodgson of a fluid level in the sphenoidal sinus.

In spite of treatment no improvement in vision occurred. On May 16 the left pupil was inactive to light and by June 28 the fundus examination showed a secondary type of optic atrophy with some narrowing of the vessels. The right eye was normal throughout and, when seen in November 1935, was quite healthy, with 6/6 vision after correction.

We infer that the massive lesion of the optic nerve was due to a direct spread of infection from a focus in the posterior ethmoidal cells and sphenoidal sinus. If so it must have occurred quite at the apex of the orbit. It will be noted that about a couple of months elapsed before the signs of a descending atrophy of the nerve were established by fundus examination. This length of time agrees pretty closely with what one expects in cases of direct tearing across of the nerve in cases of fractured base of the skull.

Perhaps after all our patient was fortunate in that the infection confined itself entirely to the nerve and that no backward spread into the cavernous sinus took place. The line that divides two such possibilities must be an exceedingly fine one.

THE EXTRACTION OF CATARACT BY THE ELECTRO-DIAFACO METHOD

(after Lopez Lacarrère of Madrid)

BY

M. KHALIL

CAIRO

CATARACT is an eye disease which necessitates the removal of the affected lens. Of all the methods used from the time of Daviel, 1745, till the present day, that which resulted in the extraction of the greater part of the diseased lens was considered best. Much better still are those methods which end in the removal of the lens in its capsule. Of the various intra-capsular methods known up to the present, one may mention (1) the category of expression —as Smith's method; (2) the category of suction—as by Barraquer's method; (3) the category of catching the lens with a blunt forceps, dislocating it, and extracting it out of the eye—as done by Elschnig, Kalt, Stanculeanu, Sinclair and others; (4) the category of removal of lens after electro-coagulation—as originated by Jess and Lopez Lacarrère. It is out of the question that I would make a comparison between this last method and the various methods of intra-capsular extraction of cataract mentioned. However, it is as always useful to increase one's armamentarium in combating diseases. My object is to describe and demonstrate by pictures

the method of Lopez Lacarrère of Madrid, which I have watched carried out by the originator himself in Madrid.

This subject is not brought forward with the pretension of its being the leading method at present, or as likely to replace other methods in future, for the extraction of immature or mature cataract, but it is presented as a novelty, which may, like many other novelties, come to our field with staggering feet at the beginning, obtaining a firmer footing later in life as it grows older, sometimes after modifications.

History of the Operation

As far as I know, no mention is made in the literature of extraction of cataracts by diathermy before the year 1931.

At the annual meeting of the Ophthalmological Society of Egypt in March, 1933, our colleague, Dr. A. F. Togby, reported his experiments on animals with the method of extraction of the crystalline lens by electro-coagulation as performed in some European clinics which he visited.

He expressed the necessity of modification of the electrode, and he devised one for this purpose. He mentioned in his references the name of Dr. Julio Lopez Lacarrère of Madrid. Shortly after that meeting we travelled to assist in the International Ophthalmological Congress, held in Madrid, in April, 1933, where we had the chance to see Lacarrère exhibit to the members of the Congress his operative technique, which he called electro-diafaco (meaning electro-penetration) in cataract extraction, and demonstrate his lecture with a cinematographic film.

He did not, however, operate during the week of the Congress and very few members of the Congress had the opportunity of seeing him operate.

After the Congress was over, I lingered behind in Madrid to be able to visit the hospitals of that city, and in one of these it was rumoured that Dr Lacarrère was to operate on cataracts by his method before a group of American doctors; I had the luck to watch him and saw Professor Emil Krueckman, of Berlin, amongst the group mentioned. Lacarrère did two operations, which were 100 per cent. true extraction after electro-coagulation.

Origin of the Idea

The attention of the originator was drawn to the use of diathermy in lens extraction from the observations of adhesion of tissues to the electric knife, rather than through cutting, in general surgery due to insufficient current. He proceeded to make use of this surgical inconvenience by experimenting on the clear lenses of rabbits.

Rabbits' Lens.

Human Lens.

FIG. 1.

Through these experiments he came across the rather interesting observation, namely, the facility of the penetration of the needle into the mass of the lens.

His primary trials surprised him by this facility of penetration of the needle into the mass of the lens more than did the enormous adherence of the latter to the needle. He attributed these results to the consistence of the normal lenses of the young animals experimented on, but his later experiments on human hard cataracts,

recently extracted, gave the same results provided the current used was sufficiently intense.

Thus he was confronted with the two main factors of success of his operation, easy penetration into the lens without backward pressure and strong adhesion of the coagulated mass to the electrode.

Experimental Period

Easy penetration proved.—The facility of penetration is demonstrated by the experiment in which the lens floating on the white of egg could be penetrated by the electrode needles without the lens being plunged into this liquid. This facility explains the advisability of extraction of dislocated cataracts by this method.

Rosary Experiment

Another interesting experiment was made by Lacarrère to demonstrate the amount of the force of traction of the electrode on the coagulated lens mass. This is demonstrated by the suspension of a rosary attached to a concave plate, the latter, riding over the top surface of a cataract lens stuck by coagulation to the electrode end. The gradual raising of the hand insures gradual augmentation of the weight without the occurrence of any shocks. This traction power amounted in some cases to 70 grams, which is illustrative when compared with that of a forceps, which did not exceed 15 grams.

However, until an experiment is devised to estimate *in vivo* and during operation the forces that oppose the exit of the lens, the rosary test remains fallacious.

Balance Experiment

In order to demonstrate the weight of pressure due to the penetration of the wires into the lens and estimate this in figures, Lacarrère did the balance experiment. A cataract lens stuck on a piece of flesh, is put on to one scale of a very delicate balance, balanced to precise level by weights put into the other scale. With the electrode handle fixed perpendicularly to the cataract, just touching its surface, a small weight of 30-50 centigrammes is sufficient to upset the equilibrium of the balance and to provoke a movement which produces the approach of the cataract to the electrode, which latter penetrates it with a minimum force. As the resistance of the weakest zonula of an aged patient is calculated to be 2 grams, it follows that luxation of the lens backwards due to the weight of penetration of the electrode wires is improbable.

Apparatus

Unlike the case in general surgery, where through repeated cuttings, the required intensity is arrived at, either by decreasing or increasing the intensity of the current, in eye surgery, or more precisely, in cataract extraction, it is essential to fix beforehand the dose required, to avoid insufficient coagulation or affection of the regions neighbouring the place of application of the electrode from over effect. So it was indispensable for Lacarrère

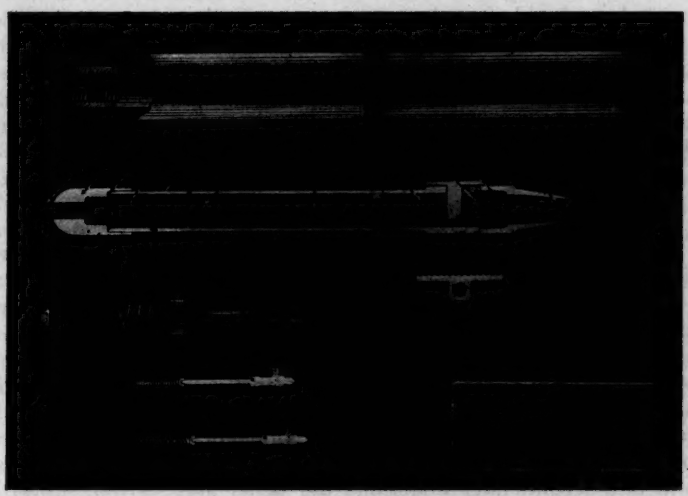

FIG. 2.

to create a technique and adopt an instrument giving a guaranteed constant and equally efficient current.

This he solved by the help of a phantom control, which permits, beforehand, the placing of the rheostat of the apparatus on the exact point which produces the maximum intensity of coagulation required, once for all, through experiments made on animals, and later actually in operations on human lenses.

Lacarrère employed a Siemens apparatus which is furnished with a modification, after his own suggestions, to estimate, beforehand, the amount of the current (about 90 milliampères) required to pass and make its effect on the lens.

His main and more important work, after thinking of utilising diathermy for the extraction of cataract, was to devise an electrode-handle.

The Electrode Carrier Handle

The construction of the handle, Fig. 2, has been very delicate work, because on this, particularly, depends the good result of the operation.

With every apparatus is supplied a handle electrode carrier, with two electrodes; one for the extraction of cataract, the other for the operation of detached retina. These consist, primarily, of a capillary glass tube, inside of which glide one or two steel wires of 0·14 mm. diameter. These metallic wires can be made to protrude outside the glass tube for a distance of about 2 mm., or more, in single or double form by pressing a spring button on the handle.

The electro-diafaco has a foot-interruptor connected to the apparatus by a flexible cable. This permits the operator himself to cut off the current at his own will, at the moment he thinks it right rather than have to depend on, or lose time by, allotting this to his assistant.

Operative Technique

The operative technique employed in the electro-diafaco operation is the following:—

One first adjusts the wires for a protrusion of 2 mm., or more, as required. After having verified, by pressing the control button and using the rheostat, that the apparatus works to a capacity of 80 or 90 milliampères, one applies the capillary tube over the anterior surface of the cataract (keeping the wires inside the tube retracted by the handle button), the moment one runs the current by pressing the pedal, the operator releases the handle button, and one second later abandons the pedal and so interrupts the current. In this manner the cataract is made to adhere to the electrode and so is withdrawn from the eye.

The needles do not, by themselves, penetrate the lens, but the way is opened for them by the electric spark; the lens thus encountering the least pressure as it is pricked by the needles.

When the needles penetrate the lens, a very adherent coagulated cristalline nucleus is formed around them.

"The time of the operation is in practice reduced to almost an instantaneous manœuvre. The slenderness of the glass rod, which is introduced into the eye, and the great power of apprehension of the instrument favours and insures, in such a way, traction, rotation or other advisable manœuvre, and makes this method extremely easy, demanding none of the manual dexterity and fine feeling necessary in the other already known methods."

Fundamental advantages.—The fundamental advantages of Lacarrère apparatus and electrodes are:—

(1) Previous regulation of current.

(2) Fixation of previously measured length of needle allowed to enter the lens substance.

(3) The bifurcation or doubled wires give a surer grip of the lens.

(4) The way the wires enter the lens avoids tearing of capsule contrary to what happens if the wires were stuck to an iron bar.

(5) Perfect isolation. Varnishes used in other electrodes do not offer the same guarantee of insulation as the glass capillary tube.

Resumè

The nucleus adhering to the needles forms with them and with the coagulated albuminoid matter, one mass or body. This coagulation so obtained, spreads in a uniform way from the outside to the inside, and laterally to the extent of 2 to 3 mm. from the extremity or end of the metallic wires. It is, consequently, on the whole central mass that it performs the traction of the cataract by means of the electro-diafaco. It can also be said that this method provokes an instantaneous partial electrical maturation of the cataract. In tumescent cataract there are possibly cases whereby the penetration of the needles and the perforation of the capsule may give rise to the exit of almost a liquid mass, but simultaneously the spark that first perforates the capsule immediately coagulates around each needle, in this way closing the whole capsular sac that adheres firmly to the needles and to the coagulated lens matter. In these cases, the lens, so reduced in volume, can be extracted completely with the greatest ease.

However, in some cases the capsule bursts from the boiling of the liquid cortex; the nucleus, when coming out, draws with it some of the soft masses. Thus one remarks the lack of pressure, in contrast to the case in cystotomy, and the fact that the lens matter comes out, drawn by its adhesion to the nucleus and not by pressing the globe. It is sometimes necessary, in spite of this, to wash out the anterior chamber in the usual manner.

Personal Experience

Taking into consideration that in almost all methods of intracapsular extraction of cataract some pressure has to be exercised, with possible consequent loss of vitreous, one should welcome any procedure that does not comprise pressure on the globe. Lacarrère has shown by his experiments that his method of extraction of the cataract is not only free from pressure on the globe, but also on the lens.

When I intended to apply this method to some cases of cataract, I tried it on the lenses of pigs' eyes. These are, however, bigger in size than the human lenses but, nevertheless, the method served to demonstrate the extent of coagulation in the lens and around the wires, and gave a rough idea about the current sufficient for the effect required. We used a Siemens apparatus (Thermoflux) which we had on trial for some time.

Of course, insufficient current would mean failure to extract the lens whereas too much current would lead to shrinkage of the lens matter with possible injury to surrounding tissues. Consequently, the success of this operation depends not so much on manual dexterity, as it does on causing the appropriate coagulation. I must here confess that it needs experience, on behalf of the surgeon, to guess his right dosage and duration of current.

I have operated on a few cases of human cataract of which two were exhibited to members of the Ophthalmological Society of Egypt. One of the two cases had keratitis for some time after the operation, probably through over-dosage.

Personal Suggestions regarding Dosage

As it is taught in diathermy that the actual amount of current affecting the site of the operation is influenced by the patient's electric resistance, there arises a fallacy in the suggestion of previously estimating the dose and fixing it on the apparatus. That is to say, you may in the case of detached retina operation, fix your current at 60 before applying it to the sclera, with the result of obtaining either insufficient coagulation or charring. To avoid such unexpected results, I thought of trying the effect of the current away from the field of operation, by applying it to the conjunctiva, for example, beforehand. Then I thought of applying the current to a raw piece of meat, stuck on the forehead of the patient to minimise experimenting on the patient's tissues. The latter test served my purposes. I have not read about it, and I am unaware of its being mentioned in the literature.

Though it was possible in operations other than cataract extractions to prophesy the required amount of electricity, I had to chance it in electro-diafaco. But the fact remains, that in the cases operated upon by Lacarrère himself, in my presence, the lens did come out promptly and unmutilated.

Unfortunately my experience in this subject could not be extended any further, as the Siemens apparatus had to be returned to its owners, and my electrode cables do not fit into the Moorfields apparatus, which our hospital possesses.

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A VISUAL ACUITY TEST FOR MALINGERERS

BY

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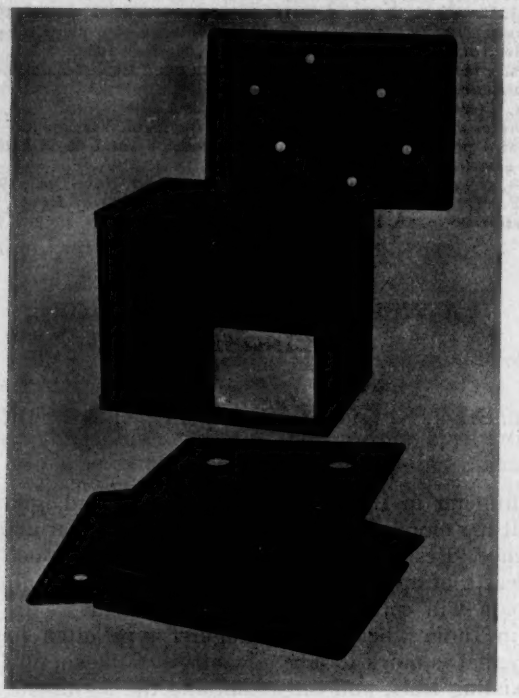
BOMBAY

THE malingerer in India is usually illiterate and ignorant. But he has all the more cunning to dodge the examiner and keep him on the fence. Besides, detection of malingerers is much hampered by the dearth of appliances which by systematic manipulation by the surgeon will certainly confuse the patient. This is especially so in India where the malingerer type often has an alert mentality that is quick to take advantage of the simplicity of most of the existing tests, and thus confound the legitimate suspicions of his examiner. I often had to spend long hours in detection of such malingerers, but never had the complete satisfaction of being convinced of their simulation. I have, therefore, longed for a test which could be used successfully with illiterate patients and, while convincing one of their malingering, would also help to determine their visual acuity fairly accurately to enable the surgeon to ascertain the percentage loss of vision. The test I have devised is capable of many variations of the positions and number of the openings in relation to the colours. Moreover, as the apertures are in Snellen sizes from 6/24 to 6/6 it has the additional advantage of being in great measure a visual acuity test. The feature of the

test is the multitude of variations. No less than four variations of each of the sizes from 6/36 can be made quickly and without the knowledge of the patient. As will be seen in the photograph the test consists of an internally illuminated box, the face of which is divided into four equal rectangles each containing coloured glasses, two of these being green, one red and one white. In front of this is placed one of a series of metal sheets in which are



apertures so arranged that by varying the way in which it is placed before the coloured squares (upright, upside down and back to front) as many as four different variations of the aperture positions are possible. The surgeon may make as many as 21 variations quickly and in a great many different progressions. Fore-knowledge of the surgeon's intentions or accurate guessing on the part of the patient is thus rendered impossible, and a malingerer, of the most cunning type, is quickly detected. The test has been made for me by Theodore Hamblin, Ltd., of 15, Wigmore Street, London.

ABSTRACTS

I.—LENS

(1) **Alajmo and Rubino (Catania).—Endocrine cataract. (La cataratta endocrina).** *Rass. Ital. d'Ottal.*, July-August, 1935.

(1) That cataract is sometimes due to disturbance of the endocrine metabolism, has been suspected for a long time; recently the theory of endocrine insufficiency has been widened so as to include even so-called senile cataract. Without going so far as this, **Alajmo** and **Rubino** attempt to show that many congenital and young cataracts are endocrinal in origin. They publish notes of three cases in one family, in which the appearance suggested endocrinal deficiency; the cataracts were of the the posterior discoid type, with multiple dotted opacities. In all three cases, further, the anterior cortex presented an unusual appearance which the authors describe as greasy map-like opacity, (aspetto untuoso a carta geografica). They discuss also, the possible importance of alteration in calcium metabolism in the production of cataract. They speak of experiments which they are pursuing with the aim of discovering the explanation of opacification of the lens. They conceive that the Ca-ion has a double action, in the first place a diminution of its concentration in the ocular fluids will change the permeability of the lens capsule which will in turn allow the passage of calcium into the lens, where by action on the lens protein, it may produce opacity.

HAROLD GRIMSDALE.

(2) **Palmieri (Padua).—The influence of ultra-violet rays on the metabolism of the lens. (Azione dei raggi ultra-violetti sull' ossidazione di alcuni acidi organici da parte del cristallino).** *Boll. d'Ocul.*, October-November, 1934.

(2) **Palmieri** has examined the time taken by the cristalline lens to decolorize methylene blue in the presence of fumarate and maleinate of potassium, after irradiation by ultra-violet rays. He exposes one eye only to the rays, using the other as control, and finds that in all cases the reduction is accelerated in the eyes that have been exposed. He concludes that the action of the rays is to loosen the intra-molecular ties so that certain parts of the molecule are freed, which uniting to the organic salt (fumarate or maleinate) form a new substance which assists the reduction of the methylene blue.

HAROLD GRIMSDALE.

II.—REFRACTION

(1) **Focosi (Florence).—The correction of myopia for near work. (Sulla correzione per vicino nella miopia).** *Boll. d'Ocul.*, October, 1935.

(1) It is not possible always to give to a myope a correction which will enable him to carry on as if he had become an emmetrope. Much more frequently we have to order the myope a glass which will allow him to work comfortably at his required range.

In high myopia, the acuity of vision is seldom normal, and it is necessary to reduce the strength of the correcting lens so as to allow the patient to come as close to his work as he finds necessary for his comfort. Further, since the lenses are not in contact with the cornea, but about 12mm. from it, the image of any object at the working distance is smaller than that seen by an emmetrope, and the diminution is greater the stronger the lens. Working on these data, **Focosi** has drawn up tables from which we can deduce the strength of lens likely to be acceptable to any given myope.

HAROLD GRIMSDALE.

(2) **Vittadini (Pavia).—Astigmatism after cataract operation. (Contributo allo studia dell'astigmatismo negli operati di catarrata).** *Arch. di Ottal.*, September-October, 1935.

(2) The curvature of the cornea depends on the balance between the intra-ocular pressure and the pull of the external muscles together with the weight of the orbicularis palpebrarum. When the eye is largely opened by incision and the lens removed, the intra-ocular pressure is reduced; and the action of the lateral recti tends to increase the curvature of the horizontal diameter of the cornea, while the vertical diameter is freed from this muscular pull and becomes flatter. Hence the considerable astigmatism that is almost constant after cataract operation.

Vittadini has examined the eyes of a number of patients before and after the operation and has measured their astigmatism at various dates after. The operations were performed either in the usual way with a large conjunctival flap or bridge, or by Nicolati's modification of Critchett's method, making the central part of the incision with a keratome and enlarging it, as required, with scissors. He finds that the method has little bearing on the amount of the subsequent astigmatism, which he finds ten days after the operation to be in some eyes as much as 15 dioptres. This rapidly decreases and after two months is nearly stationary, but in some cases change goes on for a year. The author thinks

that the method of operation with a conjunctival bridge gives more rapid healing and disappearance of astigmatism than the other methods.

HAROLD GRIMSDALE.

III.—OPERATIONS AND THERAPEUTICS

(1) **Fuchs, A. (Vienna).—The surgery of iridocyclitis. Proceedings of the All-India Ophthalmological Society.** Vol. CXI, p. 19, 1933.

(1) **Fuchs** discusses the surgery of iridocyclitis under two headings (1) operations to reduce raised intra-ocular pressure (2) operations to improve the optical state of the affected eye. Many points of practical interest are given. The author stresses the importance of a sound comprehension of the pathology of iridocyclitis, its complications and sequelae before undertaking a surgical operation. He urges the necessity for carefully estimating the intra-ocular pressure; eyes with low tension have a bad post-operative prognosis. The dangers of bleeding from thin-walled newly-formed iris vessels, dragging on the ciliary body and extensive intra-ocular manipulations are discussed.

The author advises conservative measures and the minumum of intra-ocular instrumentation. He favours Salzmann's method of performing iridectomy by opening the eye with a knife or the point of a keratome through an incision 1 mm. behind and concentric with the limbus for 6—7mm. A conjunctival flap covers this incision. The author states that this operation is more satisfactory, less liable to cause intra-ocular haemorrhage, less painful and heals better than an iridectomy performed with a Graefe knife or a keratome.

Trephining is advised for cases of chronic iridocyclitis with secondary glaucoma and a deep anterior chamber full of fluid rich in colloids, in which the intra-ocular pressure is not controlled by simpler and more conservative medical and surgical measures. He mentions that trephining is only of temporary value in the majority of cases, the trephine hole becoming occluded in a short period of time.

In cases where part of the iris is bombé and the remainder flat and closely adherent to the lens capsule the author advises iridectomy at the site of the bombé part.

The value of slit-lamp investigation is mentioned in the diagnosis of the presence of lens and vitreous opacities associated with iridocyclitis.

Extra-capsular extraction is recommended for cases of complicated cataract after a preliminary iridectomy, the object of the latter operation being to test the reaction of the eye to surgical intervention.

The indications, technique and contra-indications for other operations such as anterior sclerotomy, paracentesis, iridotomy, capsulotomy, optical iridectomy and aspiration of vitreous opacities are discussed. The paper contains some useful practical advice on a difficult subject.

H. B. STALLARD.

(2) **Duverger (Limoges).—The emergency treatment of ocular ruptures. (Le traitement d'urgence des plaises par éclatement du globe oculaire).** *Arch. d'Ophtal.*, January, 1935.

(2) **Duverger** in this paper presents arguments in favour of treating all scleral ruptures whether the overlying conjunctiva is intact or not by careful surgical toilet of the wound and co-aptation of the edges of the tear by suturing.

He maintains that the conservative treatment of scleral ruptures covered by intact conjunctiva does not of necessity prevent secondary infection of the wound and certainly is responsible for many remote complications of a serious character such as entanglement of uveal tract, scleral ectasia, and dragging and displacement of intra-ocular tissues from fibrosis.

With modern surgical technique the risk of secondary infection is very small and no greater than on undertaking a cataract operation.

A careful inspection of the wound, toilet of prolapsed tissues, cleansing and replacement followed by careful co-aptation of the wound edges favours satisfactory healing and reduces the number of serious complications that follow such injuries.

The author describes his technique. In completing the surgical toilet of the wound he uses the thermo-cautery. He does not recommend catgut for suturing the sclera but instead uses fine silk passing the needle through the conjunctiva and episcleral tissues, through the outer half of the sclera across the wound and through the sclera, episclera and conjunctiva on the opposite side. He prefers mattress sutures.

From the author's wide experience of such wounds it would appear that this method of treating all scleral ruptures whether open or closed is proper except in those cases where the eye is hopelessly damaged.

H. B. STALLARD.

(3) **Baldino (Oristano). — A perfect corneal suture. (Sutura cornela perfezionata).** *Rass. Ital. d'Ottal.*, July-August, 1935.

(3) A corneal suture is a great safeguard in simple cataract extraction and in the intracapsular operation is often indispensible. There are however, difficulties in its insertion. The usual methods tend to produce inversion of the lips of the wound or imperfect apposition. **Baldino** claims to have planned a method which will ensure perfect apposition. It is as follows; a curved needle is introduced about 1mm. within the corneal margin and made to tunnel the cornea and sclera for 2mm., the point emerging in sclerotic. The needle is left in position and the incision made in the usual way with a Graefe's knife so that the knife would come out at a place midway between the two ends of the tunnel: when the edge of the knife comes in contact with the needle, the knife is withdrawn and the section completed with a narrow sickle-shaped knife. The needle is then passed drawing its thread into the tunnel; a loop of the thread is drawn out by means of a hook to allow the passage of the opaque lens; when the thread is tied the two parts of the wound are brought into perfect apposition. (It would seem to be a little difficult to secure a conjunctival flap with this method, but it certainly seems to have perfect apposition).

HAROLD GRIMSDALE.

(4) **Balza, J. and Yalour, R. R. (Buenos Aires).—Local auto-haemo-therapy in the treatment of trachoma. (La autohemo-terapia local en el tratamiento del tracoma).** *Arch. de Oftal. de Buenos Aires*, Vol. X, p. 502, 1935.

(4) **Balza** and **Yalour** say that they have obtained excellent results in acute trachoma by the employment of auto-haemo-therapy.

In 1911 Rohner of Nancy employed general auto-sero-therapy, and in 1914 his son published many successful cases treated in this manner. Many others, for example Schachman, Dusier, used this method for various conditions. In 1925 Angelius was the first to perform this treatment for trachoma.

Leon Collin in 1926 obtained good results in trachoma cases with subconjunctival injections. Comes in 1931 gave local auto-haemo-therapy to many conditions including trachoma. For three years the authors have treated trachomatous cases in this manner.

A local anaesthetic of cocaine and adrenaline is used, and up to 2 c.c. of blood is injected into the conjunctiva; the blood is reabsorbed in from 10—12 days, and the process is repeated every

three days afterwards. Pain, blepharospasm and photophobia begin to diminish in 2 days; the ulceration heals and the pannus clears. The effects on the granulations are less marked. The method stimulates the formation of antibodies.

E. E. CASS.

(5) **Cavaniglia (Naples).—The use of pilocarpine in strong solution. (Ricerche cliniche sull'uso di colliri di pilocarpina ad alta concentrazione).** *Boll. d'Ocul.*, June, 1935.

(5) **Cavaniglia** has found pilocarpine in 1 per cent. or 2 per cent. solution often to be incapable of lowering the tension in glaucoma and has therefore made experiments on eyes both with normal and raised intra-ocular tension to see the effects of a stronger solution. He comes to the following conclusions. A 6 per cent. solution is well borne by the eye, even when dropped in several times a day. It acts more promptly and with more energy than the 2 per cent. solution.

In the normal eye, it produces a marked miosis, but no alteration of tension; in acute or subacute glaucoma, it has brought the tension down to normal within a few days and has kept it there; in chronic glaucoma the effects were less striking, but in all cases the drug was helpful.

In two cases of absolute glaucoma, the pain was relieved.

HAROLD GRIMSDALE.

(6) **Rossi (Modena).—A new substitute for eserine, "prostigmine." (Azione sull'Occhio di un farmaco sintetico eserino-simile: la prostigmina).** *Arch. di Ottal.*, October, 1935.

(6) It is some years since White and Stedmann showed that the action of eserine was due to the urethane group in its molecule and succeeded in substituting other radicals for that in eserine, thus obtaining substances which had the same action with less toxicity.

Prostigmine is one of these; it is the " dimethylcarbaminic ester of methylsulphate of m-oxyphenyl-trimethyl-ammonium." **Rossi** has tested this drug in the solution of 5 per mille (in which it is supplied), and by evaporation has produced and tested a solution of 5 per cent. He concludes that it is a powerful miotic, at least equal in that respect to eserine, and less toxic. He thinks that it should be supplied and tested in 2 per cent. solution.

HAROLD GRIMSDALE.

IV.—MISCELLANEOUS

(1) **Howell, Stacy C. (Atlanta).—Action of epinephrine on the normal human eye.** *Arch. of Ophthal.*, December, 1934.

(1) Numerous papers have been published about the action of epinephrine (adrenalin) on certain types of glaucoma, but there has been little reference to its effect on normal eyes. Howell instilled drops of a 2 per cent. solution of synthetic epinephrine into the right conjunctival sac of 50 men and 50 women in whom there was no demonstrable evidence of eye disease. His findings were as follows:—In the majority of cases there was a reduction of about 7 mm. in the intra-ocular pressure. The reduction was sometimes obtained within an hour but in most cases did not occur until later; a reduction of much smaller degree was sometimes obtained in the fellow eye. Mydriasis usually occurred within an hour and disappeared in 24 hours, its appearance was unassociated with any rise of intra-ocular pressure. In susceptible persons systemic reactions were produced (palpitation, tachycardia, tremors and nervousness). The author concludes with the recommendation of epinephrine 2 per cent. as a mydriatic for fundus examination in cases where the use of atropine or its derivatives might be dangerous.

F. A. W-N.

(2) **Margaritella (Luino).—The value of strychnine in certain eye diseases. (Contributo clinico-sperimentale all'uso della stricnina in alcune affezioni oculari).** *Lett. Oftal.*, February, 1935.

(2) Strychnine in subconjunctival injection has been used of recent years in order to have the maximum effect on the eye. On account of its toxicity ethyl-strychnine has been substituted for the original drug, having less toxicity and being less cumulative. **Margaritella** has made use of this in experiments and clinically. By its help he has been able to bring about restoration of sight in cases of toxic amblyopia which have resisted other treatment. Experiments have shown that the drug passes rapidly from the subconjunctival tissue and comes into more intimate and abundant contact with the structures which it is hoped to assist. At the same time, it must be remembered that the action is not local only, and care must be taken not to increase the dose to a dangerous amount.

HAROLD GRIMSDALE.

(3) **Puglisi-Duranti (Bologna).—Ophthalmoplegia interna. (Contributo clinico alla conoscenza della oftalmoplegia interna).** *Riv. Oto.-Neuro.-Oftal.*, April-May, 1935.

(3) Duranti reports three cases of this rare affection. He discusses the causes and the seat of the lesion. He shows that the large majority of cases are due to syphilis, acquired or inherited, but that the paralysis may occur as a complication of certain acute fevers, or as an early stage of progressive chronic ophthalmoplegia. The lesion is usually nuclear but may be anywhere in the course of the nerve.

When the lesion is in the ciliary ganglion or lower, the pupil is generally fully dilated; this serves to separate such cases from a central lesion.

Though ophthalmoplegia interna is always a very serious symptom, it may recede when due to some acute disease or to some local infection.

In the cases recited by the author, syphilis was the cause in two; diabetes in the third case.

HAROLD GRIMSDALE.

(4) **Roasenda (Turin).—A new method of testing the pupil reaction to light. (Sopra un nuovo modo di provocazione (di P. Morin) e sopra una manifestazione patilogica particolare del reflesso pupillare alla luce).** *Rass. Ital. d'Ottal.*, July-August, 1934.

(4) The method is as follows, the patient should be seated and asked to look up at a distant object. The surgeon places the lens of a pocket torch on the skin of one upper lid and draws this down, so as to cover the cornea; the lens of the lamp should lie over the region where the cornea is. The surgeon switches the lamp on and off, observing the pupil of the uncovered eye. In this way all likelihood of alteration of accommodation, such as may take place when a screen is used and suddenly removed, is, in Roasenda's opinion, absent. It is clear that the method demands an active consensual reflex. In the second part of the paper the author describes an unusual form of Argyll Robertson pupil at the beginning and at the end of the contraction to light; the pupil was circular, but close examination showed that the sphincter did not act evenly and that some parts of the circle lagged behind the others. The author has no doubt that the phenomenon, which was observed in patients suffering from general paralysis is of the Argyll Robertson type and allied to those cases in which the reaction takes place slowly.

HAROLD GRIMSDALE.

(5) **Borsellino (Palermo).—The light sense in patients suffering (*a*) from arterio-sclerosis, (*b*) from malaria. (Il senso luminoso negli arterio-sclerotici e nei malarici).** *Arch. di Ottal.*, July-August, 1935.

(5) The value of the light sense has been examined in many pathological conditions, and its estimation may help us in arriving at a diagnosis; it may even call attention to some morbid state that has been entirely overlooked.

In the estimation of the light sense in arterio-sclerosis, **Borsellino** has been at pains to exclude those suffering from any intercurrent malady, and those in whom there were any visible changes in the retina apart from the vessels.

He has examined eleven such patients and has found the light sense much reduced in all. In the majority the acuity of vision was normal or could be raised to normal with lenses.

He notes, however, that when the light sense is very much reduced there is usually also loss of visual acuity.

In the second series of examinations, the subjects were affected by malaria. Thirteen patients were examined; of these four showed no reduction of light sense. In the others there was a notable reduction, increasing with cachexia.

The author thinks that in both states the effective cause is a deficiency in the blood supply.

HAROLD GRIMSDALE.

(6) **Fuchs, Adalbert (Vienna).—Epidemic occurence of bilateral paresis of accommodation in children. (Ueber gehäuftes Auftreten von beiderseitiger Akkommodationsparese bei Kindern).** *Wien. Klin. Wochenschr.*, Vol. XLVIII, Nos. 50, December 13, 1935.

(6) During October and November, 1935, **Fuchs** saw four cases of bilateral paresis of accommodation in girls between the ages of eight and sixteen years. They all appeared to be in perfect health, and in all cases the amplitude of accommodation was reduced from about 13D. to 3 or 4D. with a consequent recession of the near point from 8cm. to from 23 to 32 cm. The cases were all private patients and no such case was observed among hospital out-patients.

The patients were all carefully examined and no cause could be found, more particularly there was no evidence whatsoever of any form of diphtheria or influenza. The author is of opinion that there must be a special aetiology for this group which further cases might elucidate.

He refers to one case reported by Genet in 1934 (*Soc. Franç. d'Ophtal.* 47-176) where a similar condition in a boy of twelve was taken to be the only symptom of an encephalitis.

A. H. LEVY.

(7) **Gallenga (Turin).—Roasenda's phenomenon in peripheral facial paralysis. Insufficient convergence.** (Il fenomeno di Roasenda nella paralisi facciale peripherica). *Rass. Ital. d'Ottal.*, May-June, 1934.

(7) Roasenda noted in 1932 that in cases of facial palsy due to peripheral lesions, the eye on the same side converged weakly. There are several forms in which this may occur. In one, convergence takes place almost normally but after a short time the affected eye ceases to converge and goes with a jump to the mid line. In others the convergence seems at first impossible but after a time the eye converges. **Gallenga** has observed a third modification, in which the eye makes a series of jumps from the mid position to convergence but eventually keeps converged. The cause of this is still to seek. The author thinks that it may be due to disturbance of the innervation of the lacrymal muscle of Duverney-Horner.

That the phenomenon is really connected with peripheral paralysis of the facial seems certain from a case quoted by the author in which surgical division of the facial nerve was followed by insufficiency of convergence, which disappeared as the nerve regained function.

HAROLD GRIMSDALE.

(8) **Shumway, E. (Philadelphia).—The association of optic neuritis, facial paralysis and facial hemiatrophy.** *Trans. Amer. Ophthal. Soc.*, Vol. XXXII., 1934.

(8) **Shumway** describes the case of a girl aged 19 years with post-papillitic optic atrophy in both eyes, the left eye being worse than the right, associated with recurrent attacks of polyneuritis affecting the 1st, 3rd, 5th, 7th and possibly the 4th, 6th and 9th cranial nerves. Right facial paralysis, enophthalmos, pallor, irregular menses and amenorrhoea for certain periods of time occurred in the year 1903, oculomotor paralysis in 1909, recurrent right facial paralysis in 1912, and in 1919 left facial paralysis then right accompanied by anosmia and loss of taste in the anterior part of the tongue.

A dental abscess was blamed as an aetiological factor.

The literature is reviewed in this paper. The author quotes Hoffman's two cases of facial paralysis associated with low grade optic neuritis and multiple neuritis; Gowers' three cases of rheumatic optic neuritis in women, two of whom had shown facial nerve neuritis and other rheumatic complications previously; de Schweinitz's two cases of retrobulbar optic neuritis occurring two years after facial paralysis; and Leszynskv's cases of left optic neuritis during an attack of facial paralysis and periostitis of the optic canal.

H. B. STALLARD.

BOOK NOTICE

Transactions of the Ophthalmological Society of the United Kingdom. Vol. LV. London: J. and A. Churchill, Limited. 1935.

The 55th volume of the Transactions contains some 638 pages of matter including lists of the Officers and Councils, Presidents, Members and a local list of members practising at home and abroad; the rules of the Society; the Communications made at the Annual Congress and at the Congresses of the affiliated Societies; the reports of the Council and the Hon. Treasurer, the Balance Sheet and the index.

The Presidential address was delivered by Mr. R. Foster Moore on the subject of radiotherapy for certain intra-ocular disorders.

Among other communications of interest are a discussion on diseases of the blood, a number of papers about retinal detachment, corneal grafting and, at the Oxford Ophthalmological Congress, an excellent cinematograph and clinical demonstration of plastic surgery of the eyelids and conjunctival sac by Sir Harold Gillies.

The Bowman lecture was delivered by Mr. C. H. Usher, his title being "On a few hereditary affections." Mr. Malcolm Hepburn gave the Doyne Memorial lecture on "The rôle played by the pigment and visual fields in the diagnosis of diseases of the fundus."

There are 548 members, 8 honorary members and 25 new members were elected during 1935. The financial affairs of the Society are in a prosperous state.

Abstracts of some of the more important contributions will appear in this Journal during the year.

OBITUARY

W. H. WILDER, M.D., of Chicago

DR. WILDER died on September 24, 1935, at the age of 74. An obituary notice appeared in the December number of the ***American Journal of Ophthalmology*** from which the following account is abstracted.

Dr. Wilder was born in Kentucky in December, 1860, of well-known parentage on his father's and mother's side, the former being a direct descendant of Edward Wilder who settled in Massachusetts in 1638.

After education at College Hill, Ohio, and Belmont, he graduated B.A. in 1878. Immediately after graduation he was a school teacher for a couple of years, while at the same time he worked at medicine. Wilder matriculated at the Medical College, Ohio, in 1880, and took his M.D. four years later. He put in five years of general practice in Cincinnati and then decided to specialise in ophthalmology. For nearly three years he was in Europe for post-graduate study under Fuchs, Leber, Virchow, Nettleship and Tweedy.

In 1891 Dr. Wilder settled in Chicago and was quickly elected Professor of Ophthalmology at the Rush Medical College. In 1926 he was appointed Emeritus Professor. Besides his professorial post he held numerous clinical appointments and he helped in founding the Illinois Society for the Prevention of Blindness, of which he was Vice-President. The Dana gold medal was presented to him for his outstanding work on the prevention of blindness in May, 1935.

Dr. Wilder was at one time President of the American Ophthalmological Society; he was Chairman of the Section of Ophthalmology, of the American Medical Association, as well as President of the Chicago Ophthalmological Society and of the American Academy of Ophthalmology and Oto-laryngology.

The keynote of Wilder's character and work was conscientiousness, and it is interesting now to recall how Nettleship's opinion of him as "a most painstaking and conscientious worker" was fulfilled. It was the same in whatever he undertook, whether in ophthalmology, business affairs or social engagements, and the same care was evidenced in all that he wrote.

His death is a severe blow to ophthalmology and much sympathy will be extended to his widow, children and grandchildren.

ADOLPH BARKAN, M.D.

IN the same issue of the *American Journal of Ophthalmology* is found the notice of the death, on August 28, 1935, of the veteran Adolph Barkan at the age of 90.

Dr. Barkan was born in 1844 and settled in America when he was 23 years old. After a year in Baltimore he moved to San Francisco where he spent the rest of his life. From the start he was a leader in ophthalmology in the Far West, and he served the city of his adoption nobly as teacher and surgeon at Stanford Medical College, where he eventually became Emeritus Professor of Ophthalmology.

His library comprised many items of ophthalmology and medical history and he presented it to the Lane medical library with an endowment to ensure its being kept up to date. He was also a great musician.

"Six feet in height, with a grey beard, very active up to the age of his retirement, he was a figure familiar to every San Franciscan."

To many of his English colleagues who attended the 13th International Ophthalmological Congress at Amsterdam in 1929 it was a great pleasure to meet this distinguished and courtly gentleman; and we extend our sympathy to his sons, Drs. Hans and Otto Barkan, who are so worthily following in their father's footsteps.

DR. AMY SHEPPARD, O.B.E., D.P.H.

We regret to record the death on January 22, 1936, of Dr. Amy Sheppard, consulting ophthalmic surgeon to the Elizabeth Garrett Anderson Hospital.

Miss Sheppard was born at Dudley, 76 years ago, the daughter of Thomas Sheppard of Kingswood, Birmingham.

After school she took up science at Mason College and matriculated in 1884. On coming to London she passed the preliminary science examination of London University and entered the Royal Free Hospital. She took the M.B. in 1892 and decided to specialise in ophthalmology, becoming a clinical assistant at Moorfields.

Her first hospital appointment was assistant physician to the New Hospital, but after a few months she resigned to become assistant ophthalmic surgeon to the Hospital. She took the D.P.H., Cambs., in 1898, being one of the first women to take this diploma.

In 1896 she became ophthalmic surgeon to the Elizabeth Garrett Anderson Hospital, where she worked till 1922, and was then elected consulting ophthalmic surgeon.

During the War Miss Sheppard served as ophthalmic surgeon at the Military Hospital, Endell Street.

Miss Sheppard's number on the roll of the London School of Medicine for Women was 140. She was thus one of the pioneers, and in ophthalmology she was essentially a pioneer among qualified women.

NOTES

The Moorfields Reports

ON page 62 we drew the attention of our readers to the fact that the management of the journal was prepared to sell back numbers and a tentative price was there announced.

Since then the matter has been gone into more carefully and the following facts are authorised.

Vols. 1 and 2 are out of print. A few complete sets of Vol. 3 can be supplied at £1 1s. Vols. 4 and 5 can be supplied at 10/6 each. Of Vol. 6, Parts 1 and 3 are out of print, the other two can be supplied at 5/- each. In Vol. 7, Parts 2 and 3 are out of print; the other 2 Parts can be supplied at 5/- each. Vols. 8 and 9 are out of print. In Vol. 10, Part 3 is out of print, the other two can be supplied at 5/- each. Vols. 11, 12, 15, 16, 17, 18, and 19 can be supplied at 10/6 each. Vols. 13 and 20 at 15/6 each, and Vol. 14 at £1 1s.

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Lectures at Glasgow

PROFESSOR BRÜCKNER, of Basel, is going to give a series of six lectures in the Ophthalmic Department of Glasgow University in April.

The general title of the course is "Physiological optics and their relation to clinical ophthalmology, and special clinical ophthalmological problems," and the individual lectures are as follows:—

Wednesday, April 15.—Some introductory observations about light and colour sensations.

Friday, April 17.—Functional dependance between stimulus and colour sensation.

Monday, April 20.—Congenital colour sense deficiency.

Wednesday, April 22.—Local adaptation of the eye.

Friday, April 24.—Light and dark adaptation.

Monday, April 27.—Endogen and exogen factors in their relation to the origin of some diseases of the eye.

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Royal Victoria Hospital, Montreal

DR. W. GORDON M. BYERS, Director of the department of ophthalmology, Royal Victoria Hospital, Montreal, has resigned and Dr. Frederick T. Tooke has been elected in his stead.

FUTURE ARRANGEMENTS

1936

March 6.—North of England Ophthalmological Society, at Liverpool.

March 12.—Royal London Ophthalmic Hospital, Annual Dinner.

March 13.—Royal Society of Medicine, Section of Ophthalmology (Clinical Meeting).

March 27.—North of England Ophthalmological Society, at Sheffield.

March 27-28.—Ophthalmological Society of Egypt. Annual Congress, at the Memorial Laboratory, Giza.

April 2-4.—Ophthalmological Society of the United Kingdom (Annual Congress), in London.

April 3.—Midland Ophthalmological Society, at Nottingham Eye Infirmary.

May 22.—Midland Ophthalmological Society, at Addenbroke's Hospital, Cambridge.

June 12.—Royal Society of Medicine, Section of Ophthalmology (Annual Meeting).

October 6.—Midland Ophthalmological Society, at Birmingham Eye Hospital.

December 1.—Midland Ophthalmological Society, at Birmingham Eye Hospital.

CONTEMPORARY OPHTHALMIC LITERATURE

American Journal of Ophthalmology. *January, 1936.*

RICE. The carbohydrate matrix of the epithelial cell inclusion in trachoma.

WOODS. Sympathetic ophthalmia.

GREEN. Bullous keratitis: a rational therapy.

BARKAN, BOYLE and MAISLER. On the surgery of glaucoma: mode of action of cyclodialysis.

BOTHMAN and ROTH. The Kayser-Fleischer ring in Wilson's disease and microcephaly.

JACKSON. Subjective studies of the blind spot and visual fields.

GRADLE. The effects of mydriatics upon intra-ocular tension.

MORSE. Magnet extraction of intra-ocular foreign bodies.

Archives d'Ophtalmologie. *December, 1935.*

DESVIGNES. Functional examination of patients operated on for retinal detachment and considered as cures.

SAMOJLOFF and TIHOMIROVA. On the diagnosis and specific treatment of tuberculous choroiditis.

LAGRANGE. Commentary on 150 systematic trials of intra-capsular extraction of the cataractous lens.

Revue d'Oto-Neuro-Oftalmologie. *January, 1936.*

MARINESCO, DRAGANESCO and GRIGORESCO. Erb's syphilitic paraplegia with atrophy of the optic nerves.

ALFANDARY. Contribution to the study of transitory amaurosis in the course of encephalitis.

Klinische Monatsblätter für Augenheilkunde. *December, 1935.*

FUCHS. Rare pathological condition after an injury.

SCHEERER. Rational physico-dietetic therapy and natural methods of treatment in eye diseases.

INOUYE. Large visual test types with uniform marks for measuring the vision = 0·02 at 5 m. distance.

ROSENGREN and KUGELBERG. The active function of the lacrymal passages in the lid movements.

STREBEL. Recurrent iritis in spondylarthritis ankylopoietica progressiva. Improvement through resection of the parathyroid glands.

January, 1936.

BARTELS. Retinal coloboma, retinal tear, retinal detachment.
VOGT. Cystoid degeneration as the cause of a large spontaneous tear at the ora of the retina and cure of the tear by catholysis. Experiments with retinal flaps.
——— Cure of a macular hole and retinal detachment by means of catholysis.
——— Modifications of internal pole magnetism for a deep firmly fixed splinter of iron, subconjunctival but not perforating.
SCHMELZER. Bilateral retinal detachment with symmetrical oral tears in two non-myopic young brothers (doubtful connection with isolated retinal cysts).
VELHAGEN. Remarks on the question of retinal detachment in juveniles and the significance of slight trauma.
ROHRSCHNEIDER. Traumatic detachment of the lens capsule in iridectomy.
VON SZILY and MACHEMER. The importance of the cathode and anode in the electrolytic treatment of retinal detachment,
SCHMID. Observations on ophthalmomyasis.
POOS. Are the centres for mydriasis and miosis excited through the carbonic acid of the blood?
ALBRICH. Contribution to the question of the formation of lymph follicles in the eye.
LÖWENSTEIN. Fat embolism as the cause of traumatic retinal angiopathy.
JESE. Demonstration of simulation and aggravation of unilateral asthenopia.
SUGANUMA. Studies of the blood pressure in the central retinal artery. Part I. The blood pressure in the central retinal artery in healthy men and its relation to the general blood pressure.
WILENKIN. The effect of the Doryls on the intra-ocular pressure and the dilatation of the pupils.
SCHUPFER. The importance of mid-brain variations in the pathogenesis of retinitis pigmentosa.
DERKAC. Plastic treatment for coloboma of the lid.

Annali di Ottalmologia e Clinica Oculistica. *November, 1935.*

CATTANEO. Research on the musculature of the lacrymal canals.
BORSOTTI. Contribution to the study of the reticulo-endothelial system of the eye by means of a modification of the technique of vital staining.
CONTINO. Cysticercus of the conjunctiva.
DUC. The Argyll Robertson sign in non-luetic affections.
CASTRIGNANI. Clinical contribution to refractive modifications in diabetics.

Archivos de Oftalmologia Hispano-Americanos. *January, 1936.*

VIDAUR. A case of Paget's disease of bone with bilateral optic atrophy.
SELLAS. Magnetic intra-ocular foreign bodies and their extraction with the electro magnet.

Revista Oto-Neuro-Oftalmologica y de Cirugia Neurologica. *January, 1936.*

MAYER. The value of retinography in ophthalmology.
TILLE. Ocular manifestations of suppurative otitis and its complications.
PAVIA. Ophthalmoscopy of arterial hypertension. Retinal angioscopy.

Archivos de Oftalmologia de Buenos Aires. *November-December, 1935.*

WERNICKE. Hereditary ocular carcinoma in cattle.
BALADO and MALBRÁN. Optic atrophy of a surgical nature. Its treatment.